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AIR INTELLIGENCE INFORMATION REPORT

COUNTRY OR AREA REPORT CONCERNS

USSR

DATE OF REPORT

30 March 1959

SUBJECT (Descriptive title. Use individual reports for summary reports.)

DEVELOPMENT OF SOVIET RIVERS FOR ELECTRIC POWER PRODUCTION

SUMMARY (Give summary which highlights the salient factors of narrative report. Begin narrative text on AF Form 112a unless report can be fully stated on AF Form 112. List inclosures, including number of copies)

1. Forwarded herewith is a comprehensive report on the Hydroelectric Power Development in the USSR based on information found in Soviet open sources listed at the end of this report
2. The report consists of an introduction and Parts I and II. The introduction briefly describes the hydropower resources of the Soviet Union and their distribution. Part I describes major Soviet rivers which can be utilized for power development and names all power plants proposed and built on these rivers. Part II tabulates all significant hydroelectric power plants, built, under construction, or proposed for the near future. Unimportant plants of low capacity (agricultural, etc) are omitted.
3. The value of this report lies in the fact that it gives a clear picture of the present state of Soviet hydroelectric progress and presents a compact up-to-date reference work containing basic information on all major Soviet rivers and power developments. To facilitate the use of this report as a reference tool it is provided with river and power plant name indices, containing references to about 100 rivers and 300 power plants.

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All inclosures listed on page 2.

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1. Distribution and concentration of hydropower resources by USSR economic regions (map)
2. Distribution and concentration of hydropower resources by USSR economic regions (diags.)
3. Runoff of the largest Soviet rivers (map)
4. Hydropower resources of the largest Soviet rivers (diag.)
5. Location of the most important hydroelectric power plants in the USSR (map)
6. The rate of hydropower development in the USSR (graph)

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DEVELOPMENT OF SOVIET RIVERS FOR ELECTRIC POWER PRODUCTION

Introduction

Potential Hydropower Resources and their Distribution

The total potential hydropower resources of all Soviet rivers are estimated at 420 million kw or 3,680 billion kwhr, which is about 11.4% of the world's total waterpower resources.

On the basis of the latest survey of Soviet rivers taken in 1946-1950, the "Gidroenergoprojekt" (All-Union Trust for the Design and Planning of Hydroelectric Power Plants and Hydroelectric Developments) of the USSR Ministry of Electric Power Stations evaluated the theoretical hydropower resources of the 1,477 major Soviet rivers to be 340 million kw of mean annual capacity or 2,978 billion kwhr of mean annual output. It is estimated that only about 50 to 58% of these resources could be actually transformed into electric energy. Therefore, the power resources of these 1,477 rivers, technically possible for utilization, may be estimated at 196.5 million kw and 1,720 billion kwhr.

Considering various characteristics of certain rivers and economic development of the regions through which they flow, the mean annual hydropower capacity of these 1,477 rivers should be further reduced and, in the final analysis, estimated at 137 million kw and 1,200 billion kwhr.

As can be seen in inclosures 1 and 2 and in tables A, B and C, hydropower resources are very unevenly distributed over Soviet territory.

Table A

Distribution of Surveyed Hydropower Resources
in European and Asiatic Russia

Territory	Area 1,000 km ²	Estimated Hydropower Resources			
		1,000 kw	billion kwhr	%	1,000 kwhr/km ²
European Part and Caucasus	5,074.0	60,225	528	17.7	104.6
Asiatic Part	17,196.6	279,775	2,450	82.3	143.0
USSR	22,270.6	340,000	2,978	100.0	133.7

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Table B

Distribution of Surveyed Hydropower Resources
by Soviet Republics

Soviet Republics	Area 1,000 km ²	Estimated Hydropower Resources			
		1,000 kw	billion kwhr	%	1,000 kwhr/km ²
Armyanskaya	29.8	1,679	14.7	0.5	493.6
Azerbaydzhan- skaya	85.7	3,828	33.5	1.1	391.3
Belorusskaya	207.6	636	5.6	0.2	26.8
Estonakaya	45.1	68	0.6	0.1	13.2
Gruzinskaya	76.2	11,116	97.4	3.3	1,277.9
Kazakhakaya	2,753.8	15,063	131.9	4.4	47.9
Kirgizakaya	196.9	15,224	133.4	4.5	677.3
Latviyskaya	64.5	611	5.4	0.2	83.0
Litovskaya	65.2	436	3.8	0.1	58.6
Moldavskaya	33.8	366	3.2	0.1	95.2
RSFSR	17,100.5	249,243	2,183.3	73.3	183.3
Tadzhikskaya	142.6	26,845	235.2	7.9	1,649.1
Turkmenakaya	484.8	2,702	23.7	0.8	48.8
Ukrainskaya	576.6	5,046	44.2	1.5	76.6
Uzbekakaya	407.5	7,137	62.5	2.1	153.4
USSR	22,270.6	340,000	2,978.4	100.0	133.7

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Distribution of Surveyed Hydropower Resources
by Economic Regions of the USSR

Regions	Area 1,000 km ²	Estimated Hydropower Resources			
		1,000 kw	billion kwhr	%	1,000 kwhr/km ²
Northern	1,146.2	6,614	57.9	1.9	50.5
Northwestern	488.1	3,589	31.4	1.1	64.3
Western	398.2	1,782	15.7	0.5	39.2
Central	983.1	3,720	32.6	1.1	33.2
Rovolzh'ye (Volga Region)	480.4	6,456	56.6	1.9	117.8
Southern	610.4	5,412	47.4	1.6	77.7
North Caucasus	384.3	11,291	98.9	3.3	257.4
Transcaucasus	191.7	16,623	145.6	4.9	759.5
Urals	760.2	5,009	43.9	1.5	57.7
West Siberia	2,423.6	24,132	211.4	7.1	87.2
Central Asia	1,231.8	51,908	454.8	15.3	369.1
Kazakhstan	2,753.8	15,063	131.9	4.4	47.9
East Siberia	7,410.2	140,815	1,233.5	41.4	166.5
Sov. Far East	2,915.1	47,586	416.8	14.0	143.0
USSR	22,270.6	340,000	2,978.4	100.0	133.7

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The rate of hydropower development in the USSR is shown in Incl. 6 and Table D.

Table D**Increase of Hydropower by Five-year Plans**

Years	Capacity		Output	
	Hydropower Plants 1,000 kw	% of Total Power	Hydropower Plants million kwhr	% of Total Output
1940	1,587	14.1	5,113	10.5
1945	1,252	11.2	4,841	11.2
1950	3,218	16.4	12,691	13.8
1955	5,986	16.0	23,165	13.6
1960 (plan)	---	---	59,000	18.4

Location of the most important hydroelectric power plants in the USSR is indicated in Incl. 5.

As of today the Soviet water resources are far from being completely exploited. In 1956 hydroelectric power plants generated 29 billion kwhr, which is only 1.5% of the utilizable hydropower resources.

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PART I**Major Soviet Rivers Which Can Be Utilized For Power Production**

The vast territory of the Soviet Union (22.3 million sq km) is covered by an extensive system of rivers (Incl. 5) which accounts for about 13% of the world's annual stream flow.

River resources of the Soviet Union presented in terms of length, drainage, and discharge are shown in tables E, F, and G:

Table E**Data on Length of Soviet Rivers**

2,000 km and more	14 rivers
1,200 - 2,000 km	17 "
600 - 1,200 km	74 "
300 - 600 km	260 "
100 - 300 km	more than 1,300 rivers

Table F**Data on Drainage Area of Soviet Rivers**

1,000,000 sq km	7 rivers
100,000 sq km	52 "
100 sq km	more than 100,000 rivers

Table G**Data on Discharge Capacities of Soviet Rivers**

More than 17,000 m ³ /sec	1 river
15,000 - 17,000 "	1 "
12,000 - 15,000 "	1 "
10,000 - 12,000 "	1 "
8,000 - 10,000 "	1 "
6,000 - 8,000 "	1 "
5,000 - 6,000 "	1 "
4,000 - 5,000 "	2 "
3,000 - 4,000 "	6 "
2,000 - 3,000 "	6 "
1,000 - 2,000 "	16 "
300 - 1,000 "	71 "

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The runoff and hydropower resources of the largest Soviet rivers are shown in Incl. 3 and 4.

Basic hydrological characteristics of individual rivers are presented below. Criteria for covering these rivers are based on hydropower utilization (present and planned for foreseeable future) and not on their size or other considerations.

To facilitate a systematic study, rivers have been grouped by the following basins and regions:

A. European Russia

- I. Kola Peninsula and Karelia
- II. Baltic Sea and Lake Ladoga Basin
- III. Black and Caspian Seas Basin (excluding Caucasus)
- IV. Caucasus (North Caucasus and Transcaucasia)

B. Asiatic Russia

- V. Central Asia and Kazakhstan (excluding Irtysh Basin)
- VI. Siberia and Soviet Far East

A. European Russia

I. Rivers of Kola Peninsula and Karelia

Rivers of this region flow through Murmanskaya o. and Karel'skaya ASSR. They belong to the basins of Barents and White Seas and Lake Onega. Rivers of this region have following characteristics: they flow through many lakes; sections of the rivers between the lakes have many rapids; river beds are composed of granite or gneiss.

Rivers of Barents Sea Basin.

Paats-Ioki River flows in the most northern part of Murmanskaya oblast in the region bordering with Finland and empties into the Barents Sea. The present hydropower development consists of the following three power plants (Incl. 5 and Table I): the Kaytakoski (under construction), Yaniskoski (completed in 1951), and Rayyaskoski (completed in 1955). The fourth plant, the Borisoglebskaya station, is planned for construction in indefinite future. No detailed information on these power plants is available. The Rayyaskoski Power Plant is interconnected with the Kolenergo power system, and it is very likely that the other power plants are also included into this system.

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Tuloma River Basin is a system of rivers and lakes, the total length of which is 300 km. The Tuloma River proper flows out of Lake Notozero, Murmanskaya o., in the northwestern section of the Kola Peninsula and discharges into the Kola Bay of the Barents Sea. The length of the Tuloma River is approx. 64 km. The drainage area of the entire basin is 22,800 sq km. The average annual discharge of the river is 200 m³/sec. The maximum flow measured at the site of the Tuloma Dam was 1,942 m³/sec, and the minimum winter flow was 51 m³/sec.

At present there is one 48,000-kw power plant, the Tuloma Station, in operation (see Incl. 5 and Table 1). It is mentioned that another power plant, the Upper Tuloma, could be built on this river. The Tuloma Power Plant belongs to the Kolenergo power system.

Rivers of the White Sea Basin

Niva River is located in Murmanskaya oblast. It flows out of Lake Imandra and empties into the Kandalaksha Bay of the White Sea. The total length of the river is 36 km; the catchment area, including Lake Imandra, is 12,800 sq km; the average annual discharge 160 m³/sec; and the fall of the river 126 m.

The Niva River is divided by the lakes Pinozero and Flesozero into three sections -- the upper, middle, and lower. Correspondingly, the entire hydro-power resources of the Niva River are utilized by three hydropower plants -- Niva I, Niva II, and Niva III (See Table 1).

Kuma-Iova-Kovda River System. This river system originates in Lake Topozero (Karel'skaya ASSR) and empties into the Kandalaksha Bay of the White Sea (Murmanskaya o.). The rivers flow through many lakes and have seven names along their 244-km course, of which 145 km are measured through lakes. At the beginning, the river is called the Sof'yanga, then Kundozerka, Kuma, Rugozerk, Kovdochka, Iova, and finally the Kovda River which flows out of Lake Kovdozero and falls into the Kandalaksha Bay. Large estuary of the Kovda River is called Knyazh'ya Guba. The catchment area of the Sof'yanga-Kuma-Iova-Kovda River system is 28,000 sq km and the average annual discharge 280 m³/sec.

At present there is one power plant (Kuma) under construction on the Kuma River, one power plant (Iova) under construction on the Iova River, and one power plant (Knyazhegubakaya -- Knyazh'ya Guba) in operation on the Kovda River (see Incl. 5 and Table I).

Kem' River begins in Finland, carrying in Finland the name of Pista. It crosses the Finnish-Karelian border and flows in Karel'skaya ASSR under the name of Kem' River. It flows through several small and large lakes and empties into the White Sea. The length of the entire river is 385 km and of the Kem' River proper 188 km. Drainage area of the entire basin is 29,040 sq km and the average annual discharge -- 270 m³/sec. The utilization of the river's power resources started by building the Kem' State Regional Hydroelectric Power Plant. This power plant was in the initial stage of construction in 1947. No further information is available.

Vyg River is located in Karel'skaya ASSR. It starts in a small lake bordering Arkhangal'skaya o., flows through Lake Vyg and empties into Onega Bay of the White Sea. The area occupied by the lake accounts for 21% of the entire river basin. The section of the river above Lake Vyg is called the Upper Vyg River, and the section below the lake is called the Lower Vyg River. The length of the Upper Vyg River is 130 km and of the Lower Vyg River 112 km. The length

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of Lake Vyg is 69 km. The drainage area of the entire Vyg River basin is 29,500 sq km. The average annual discharge is 290 m³/sec. The Vyg River is a part of the Belomorsko-Baltiyskiy Canal (White Sea Canal) -- a waterway system which connects the White Sea with the Baltic Sea.

At present the water flow of the Vyg River is utilized by the Matkozhnya (Matkozhnenskaya) Hydroelectric Power Plant, which has been in operation since 1953. Another power plant, the Vygostrov (Vygostrovskaya), is scheduled for completion during the sixth Five-year Plan. A 1955 source states that it is possible to build altogether six medium-capacity power plants on the Vyg River.

Onda River is a left tributary of the Vyg River. This 133-km long Karelian river starts in Lake Ugl and flows through the Lake Onozero.

The hydropower resources of this river are at present utilized by the Onda Hydroelectric Power Plant (Incl. 5), which was completed in 1956. The Onda hydro-station is interconnected with other power plants of the White Sea waterway system. It belongs to the Central-Karelian power system.

Rivers of the Lake Onega Basin

Suna River is located in Karel'skaya ASSR. It starts near the Finnish border and empties into the Kondopoga Bay of the Lake Onega. Suna River is 292 km long. It flows through several lakes, which comprise 28% of the total length of the river. The drainage area is 7,730 sq km, the average annual discharge about 75 m³/sec.

The water flow of the river is utilized by three hydroelectric power plants built on the Suna River diversion system. This system consists of a series of canals which divert at the Girvas settlement a great part of the Suna flow via lakes Pal'ye, Sandal, and Nigo into the Kondopoga Bay of Lake Onega. The Pal'ye Power Plant (Pal'ye Ozernaya) is located near Girvas settlement, the Pal'ye-Sandal Station (Pal'ye Sandal'skaya) is presumably built on the canal connecting Lakes Pal'ye and Sandal, and the Kondopoga Power Plant is built on the canal between Lake Nigo and Lake Onega (see Table I).

II. Rivers of the Baltic Sea and Lake Ladoga Basin

The major rivers of this region are: Vuoksa, Svir', Volkhov, Narova, Zapadnaya Dvina, and Neman.

Lake Ladoga Basin

Vuoksa River flows out of Lake Saimaa in Finland and empties into Lake Ladoga in the northwestern part of the Leningradskaya oblast. The river is 150 km long. The catchment area of the entire river basin, including Lake Saimaa, is 69,500 sq km and of the river alone 7,300 sq km. The average yearly discharge at Lake Saimaa is 645 m³/sec.

The upper part of the river, located in Finland, has many rapids, including the famous Imatra Falls. Power resources of this section of the river are utilized for power by Finnish government.

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The flow of the middle section of the river, located in the Soviet Union, is at present utilized by two hydroelectric power plants -- Enso in Svetogorsk and Rouhiala in Lesogorskiy (See Incl. 5 and Table II). Another power plant, the Lower Vuoksa, is proposed for construction on this river at Lake Ladoga (Incl. 5). The Enso and Rouhiala power plants belong to the Leningrad power system.

Svir' River is located in Leningradskaya oblast. It flows out of Lake Onega and empties into Lake Ladoga. The river is 224 km long; its total fall is 28 m; drainage area, including Lake Onega, is 83,200 sq km; the mean annual discharge is 790 m³/sec; the minimum discharge 120 m³/sec; the maximum discharge 1,450 m³/sec.

The Svir' River is a part of the White and Baltic Seas waterway system.

The hydropower resources of the Svir' River are fully exploited by two hydroelectric power plants: the Upper Svir' and the Lower Svir' (See Incl. 5 and Table II).

Both power plants belong to the Leningrad power system.

Volkhov River flows out of Lake Il'men (Novgorodskaya o.) and discharges into Lake Ladoga (Leningradskaya o.). It is 224 km long and has a total fall of 13 m. The drainage area, including Lake Il'men Basin is 80,200 sq km. The mean annual discharge is 580 m³/sec, the minimum discharge is 44 m³/sec and the maximum discharge 2,900 m³/sec.

The power resources of the Volkhov River are utilized by the Volkhov Hydroelectric Power Plant im. V. I. Lenin (See Incl. 5 and Table II), located in the lower reaches of the river below the Gostinopol'skiye Rapids.

The Volkhov Power Plant belongs to the Leningrad power system.

Baltic Sea Basin

Narva (Narve) River flows along the border between Estonian SSR and Leningradskaya o. It flows out of Lake Chudskoye (Peipus) and empties into the Narva Bay of the Gulf of Finland. The river is 77 km long. The drainage area, including the area drained by lakes Chudskoye and Pakovskoye, is 56,000 sq km, out of which only 14.6% constitutes the actual catchment area of the river. The mean annual water discharge is 430 m³/sec. The total fall of the river is 31 m. The 6-m fall occurs in the 6-km stretch of the Omutinskiye Rapids (upper reaches of the river) and the 19-m fall in the 2-km stretch of the Narva Falls in the middle section of the river.

Power resources of the Narva River can be fully exploited by two hydroelectric power plants, one in the region of the Omutinskiye Rapids and another in the region of Narva Falls. The Narva Power Plant (See Incl. 5 and Table II) has been in operation since 1955. The Omutinskaya power plant, if ever built, will raise the level in Lake Chudskoye and thus will improve the water flow of the river.

Zapadnaya Dvina (Daugava) River has its source in the Valdai Hills, not far from the source of the Volga River, and empties into the Gulf of Riga of the Baltic Sea. It flows through the territories of RSFSR, Belorusskaya SSR and Latviyskaya SSR. The length of the river is 1,020 km; the total fall -- 220 m; the drainage area -- 85,100 sq km; the mean annual discharge -- 680 m³/sec.

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There are several rapids on the river.

At present there are the following power plants built, under construction, or planned for immediate construction on the river: The Vitebsk power plant (survey completed in 1956), Plavinas (Plyavin'skaya; construction scheduled to start in 1956-1960), and Kegums (Kegumskaya; completed in 1939) (See Incl. 5 and Table II). One 1957 source lists 9 power plants, including the Vitebsk, Plavinas, and Kegums, as possible for construction on the Zapadnaya Dvina River.

The other six power plants mentioned in this source are: Beshenkovichi, Druya, Daugavpils, Yekabpils, Mstamenskaya, and Dolenskaya.

Neman River flows through Belorusskaya and Litovskaya SSR, bordering in its lower reaches with the Kaliningradskaya o. It begins about 40 to 45 km SSW of Minsk and flows into the Gulf of Kursk of the Baltic Sea.

The length of the river is 937 km; the total fall -- 179 m; the drainage area -- 98,100 sq km; the mean annual discharge at the mouth -- 690 m³/sec.

The hydropower resources of the Neman River are estimated to be 400,000 kw.

There are considerable rapids in the upper and middle reaches of the river.

At present, there is only one hydroelectric power plant, the Kaunas, on the river. This station (See Incl. 5 and Table II) is under construction since summer 1956 and is scheduled to start operations in 1959. Upon completion of the Kaunas power plant the construction will start on the Sovetsk power station in the lower reaches of the river near Jurbarkas in Litovskaya SSR. All in all it is proposed to build 8 power plants, including the Kaunas and Sovetsk stations, on the Neman River. The remaining 6 power plants are: Dokudovskaya, Mosty (Mostovskaya), Grodno, Druskininkai, Alitus, and Birstonas power plants. Construction of these power plants will begin in the unforeseeable future.

III. Rivers of Black and Caspian Seas Basin (excluding Caucasus)

This chapter deals with the following rivers: Dnestr, Tereblya and Rika, Dnepr, Don, Volga, Kos'va, Chusovaya, Ufa, and Ural Rivers.

Dnestr River originates in the northern slopes of the Carpathian Mountains at an elevation of 900 m above sea level and empties into the Black Sea. It flows through the southern part of Ukrainian SSR and Moldavskaya SSR. The length of the river is 1,410 km, the drainage area -- 72,000 sq km, and the mean annual discharge -- 330 m³/sec.

At present, there is only one hydroelectric power plant, the Dubossary, on the Dnestr River (Incl. 5 and Table III). Construction of another hydroelectric power plant, the Kamenka, was scheduled to begin in 1956-60. There is no evidence, however, that the construction of the Kamenka Power Plant has begun. One 1958 source approved the idea of building still another hydroelectric power plant at the Mogilev-Podol'skiy. A 1957 source mentions that the entire hydropower resources of the Dnestr river could be utilized by the following nine hydroelectric stations: Nizhnevskaya, Unizhskaya (Incl. 5), Zaleshchinskaya, Zhvanchikskaya, Mogilev-Podol'skiy (Incl. 5), Kremenskaya, Yampol'skiy, Kamenka (Incl. 5), and Dubossary (Incl. 5).

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Tereblya and Rika Rivers. These two mountain rivers rise in the Carpathian Mountains and flow, separated by a mountain range and paralleling each other, into the Tissa River which is the largest (left) tributary of the Danube River. The Tereblya River flows at an elevation 200 m higher than the Rika River. This difference in elevations was utilized at the Tereblya-Rika (Zakarpatskaya) Hydroelectric Power Plant (Incl. 5 and Table III). The dam of this power station was built on the Tereblya River and the powerhouse on the Rika River. A 3,600-m tunnel was cut through the mountains to divert the water from Tereblya River to the powerhouse on the Rika River.

Dnepr River rises in the southern spurs of Valday Hills in northern part of Smolenskaya o., RSFSR, at an elevation 250 m above the sea level. It flows in southern direction through Belorusskaya SSR and Ukrainskaya SSR and empties into the Black Sea a little below the city of Kherson.

Dnepr is 2,285 km long; its drainage area is 503,000 sq km; the average yearly runoff -- 53 billion cu m; the mean annual discharge (at the mouth) -- 1,700 m³/sec; total fall -- 253 m; and the average incline -- approx. 11 cm per 1 km.

The river is characterized by an uneven flow. Its annual runoff varies from 24 to 73 billion cu m and its flow (below Kiyev) fluctuates between 200 and 25,000 m³/sec. Dnepr is fed mostly by snow precipitations and, therefore, it has severe spring floods. About 60 to 70% of its annual runoff takes place in spring.

According to its hydrological characteristics Dnepr can be divided into 2 sections -- the upper Dnepr (between the source and Kiyev) and the lower Dnepr (between Kiyev and the Black Sea). About 85% of hydropower resources of the Dnepr River are concentrated in its lower section.

The plan for the lower Dnepr development consists of the following hydroelectric power plants: the Kiyev station, Kanev, Kremenchug, Dneprodzerzhinsk, Dnepr Power Plant im. Lenin, and Kakhovka (Incl. 5 and Table III). Of these power plants the Dnepr im. Lenin (Dneproges) is the largest. However, because of a very small reservoir, the station operates in autumn and winter at a reduced capacity. This situation will be remedied after the Kremenchug Hydroelectric Power Plant is built. The Kremenchug station will have a very large reservoir which will regulate the operation of the Dneproges and of the Dneprodzerzhinsk stations. When the Kremenchug reservoir is built, the Dneproges will increase its power production by 500,000,000 kwhr a year. There is even a plan to expand the Dnepr Power Plant im. Lenin by building another powerhouse equipped with six 125,000-kw generating units. Four of these units could be put into operation during 1961-1965 and the remaining two during 1966-1970. The total capacity of all hydroelectric stations which could be built on the lower Dnepr would then exceed 3,000,000 kw and their power output would exceed 10,000,000,000 kwhr. When all power plants of the lower Dnepr will have been built, the flow of the river between Kanev and Kherson will be completely regulated and navigation between these two cities assured.

The upper reaches of the Dnepr river will be developed mostly for navigation and land reclamation purposes. Power production here is only of a secondary value. The following 8 power plants are tentatively planned in this section: the Dorogobuzh, Smolensk, Orsha, Mogilev, Vilyakhovka, Zhlobin, Rechitsa, and, finally, below the confluence of Dnepr with the Sozh River, the Lyubech power plant. These eight power plants could develop the capacity of 200,000 kw.

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Don River rises in the eastern slopes of the Central Russian Plateau (Sredne-Russkaya Vozvyshennost') not far from the city of Stalinogorsk, Moskovskaya o., at an elevation of 190 m above sea level. It flows through Tul'skaya, Ryazanskaya, Lipetskaya, Voronezhskaya, Stalingradskaya, and Rostovskaya oblasts of the RSFSR and empties into the Azov Sea. Its length is 1,970 km; drainage area -- 422,000 sq km; mean annual discharge -- 900 m³/sec, and an average annual runoff (at the site of Tsimlyanskaya Dam) is 23 billion cu m. Don River is a typical valley river. It flows through a very level terrain. Its average incline is 0.1 o/oo.

The Don River is interconnected by the 101-km long Volga-Don Canal in V. I. Lenin with the Volga River.

At present there is one hydroelectric power plant, the Tsimlyanskaya, (Incl. 5 and Table III) built on the Don River. One 1955 source mentions that it is possible to build four more power stations below the Tsimlyanskaya Dam near the following settlements: Nikolayevskaya, Konstantinovskiy, Milikhovskaya and Aksayskaya.

Volga River is the most important waterway of the European Russia. It originates in the Valday Hills in the Kalininskaya o., 228 m above sea level, and empties into the Caspian Sea, which is 28 m below sea level.

Volga flows through the following oblasts and autonomous republics of the RSFSR: Kalininskaya o., Yaroslavl'skaya o., Kostromskaya o., Ivanovskaya o., Gor'kovskaya o., Mariyskaya ASSR, Chuvashskaya ASSR, Tatarskaya ASSR, Ul'yankovskaya o., Kuybyshevskaya o., Saratovskaya o., Stalingradskaya o., and Astrakhanskaya o. More than 350 cities and one third of the country's entire population are located in the Volga River catchment basin. This area accounts also for more than 50 percent of the country's industrial and agricultural output.

The basic hydrological data on the Volga River is as follows:

length -- 3,690 km
total fall -- 256 km
average incline -- 7 cm per 1 km
drainage area -- 1,380,000 sq km
average yearly runoff -- 250 cu km
mean annual discharge:

Upper Volga

at Ivan'kovo Dam	--	300 m ³ /sec
" Uglich Dam	--	400 "
" Shcherbakov Dam	--	1,100 "
" Gor'kiy Dam	--	1,700 "

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Middle Volgaat Cheboksary -- 3,550 m³/secLower Volga

" Kuybyshev Dam	-- 7,600 "
" Saratov	-- 7,800 "
" Stalingrad	-- 8,000 "
" estuary	-- 8,000 "

The Volga River now connects by means of several complex canal systems the White, Baltic, Caspian, Black, and Azov Seas.

In accordance with its flow characteristics, Volga River is divided into three sections: upper, middle, and lower. The Upper Volga extends from the source to the confluence with the Oka River, the Middle Volga stretches from the Oka to the Kama River, and the Lower Volga from the Kama to the Caspian Sea.

In order to exploit the Volga River most completely for power production, navigation and irrigation, a complex plan has been worked out. According to this plan a chain of hydroelectric power plants (see Incl. 5) is to be built on the Volga and Kama rivers. When these power plants are built, the flows of Volga and Kama rivers will have been completely regulated from the Caspian Sea up to Ivan'kovo and Solikamsk, respectively. At present, the plan for the Volga River Development includes the following power plants: Ivan'kovo, Uglich, Shcherbakov, Gor'kiy, Cheboksary, Volga im. Lenin (formerly Kuybyshev), Saratov, and Stalingrad (Incl. 5 and Table III). In addition to the above plants, the plan for the development of the Volga River also includes the Lower-Volga (Astrakhan') Power Plant (Incl. 5 and Table III). However, it is very problematical whether the Lower-Volga Power Plant will be ever built. If built, it will be located near Yenotayevka, approximately 172 km upstream of Astrakhan'. The following four small power plants might be built in upper reaches of the Volga River: "Krivorogskaya", Rzhev, Staritsa, and Kalinin.

Oka River is the second largest (right) tributary of the Volga River. It rises in Orlovskaya o. and flows into Volga at the point where the city of Gor'kiy is located. Oka is 1,480 km long, its drainage area is 245,000 sq km and the mean annual discharge 1,200 m³/sec.

Except for a few inter-kolkhoz hydroelectric power plants built in the upper reaches, hydropower resources of the Oka River are not yet utilized. However, when the problems of the third Five-year Plan were discussed, the question of building one hydroelectric power plant was raised. This power station was to be built 5 km above the city of Kaluga, its head was to be 28 m (at dam), reservoir -- 4.2 billion cu m, capacity -- 150,000 kw, and power output -- 520 million kwhr.

In 1946, it was decided in the Ministry of Electric Stations that the planning of the Kaluga Hydroelectric Power Plant must have been completed in 1947 so that the construction of this station could start in 1948. There is no evidence, however, that the construction of this station was ever started.

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Kama River is the largest tributary (left) of the Volga River. It rises in the Upper-Kama Highlands from four springs at the Karpushino Hamlet, near the Kuligi Village, Udmurtskaya ASSR, at an elevation 331 m above sea level and flows into Volga at 36-m elevation. The elevation of the Kama River at the city of Perm' is 87 m, at Sarapul 64 m, and at Chistopol' 45 m. The average fall of the river is 11 cm per 1 km. The length of the Kama River is 2,030 km; its drainage area is 522,000 sq km; mean annual discharge at Lower-Kama Dam 3,800 m³/sec, at Votkinsk Dam 1,700 m³/sec, and at Perm' Dam 1,650 m³/sec; average annual runoff 130 km³, which is almost 50% of the average runoff of the Volga at Stalingrad. 58% of the entire runoff passes during the spring season, 17% in summer time, 10% during the fall, and 15% in winter time.

There is a plan to increase the flow of the Kama River by diversion of waters from Vychegda and Pechora rivers. However, the realization of this plan will present such difficulties that it is highly problematical that it will be implemented in the foreseeable future.

The plan for the development of the Kama River provides for the construction on Kama of the following four hydroelectric power plants: Solikamsk, Kama, Votkinsk, and Lower-Kama (Table III).

Kos'va River, left tributary of the Kama River, rises in the swamps of the western slopes of the Main Ural Mountain Ridge. It is 354 km long, its drainage area is 8,070 sq km and the mean annual discharge at the Shirokovskaya Power Plant 69 m³/sec.

One 1945 source mentions that six hydropower plants (Totyl, Upper-Kos'va, Troitskoye, Nyar, Shirokovskaya, and Lower Shirokovskaya) might be built on this river. Only the Shirokovskaya plant (Incl. 5 and Table III) has been built and is in operation since 1947. There is no evidence that the remaining power plants will be built in foreseeable future.

Chusovaya River is a left tributary of the Kama River. It originates in the western slopes of the Ural Mountains. Its length is 802 km, drainage area 47,600 sq km, its mean annual discharge 420 m³/sec, and average annual runoff 13 billion cu m. One 1945 source reported that the NKVD of the USSR has worked out a plan for the construction of a chain of six hydroelectric power plants with a combined capacity of 120,000 kw and an output of 528 million kwhr on Chusovaya River. Of these six stations only the Ponysh station, located 3.5 km downstream from the confluence with Ponysh River, was mentioned as under construction since 1942. This information was not confirmed by later available sources.

Ufa River is a right tributary of the Belaya River, which is a left tributary of the Kama. Ufa flows out of a small lake in Central Ural Mountains in Chelyabinskaya o. at an elevation of about 500 m above sea level. It flows through Sverdlovskaya o. and Bashkirskaya ASSR. Its length is 912 km and the drainage area -- 52,700 sq km.

According to pre-war estimates seven power plants with combined installed capacity of approximately 330,000 kw can be built on the Ufa River. As of now (1958) only the Pavlovka station (Incl. 5 and Table III) is about ready to be put into operation. A 1957 source hints that the construction of another power plant (named Varyazhskaya) is contemplated upon completion of the Pavlovka station.

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The Ural River rises in the Ural-Tau Ridge of the Ural Mountains and empties into the Caspian Sea. It is 2,354 km long, its drainage area is 220,000 km² and its average runoff is 5 m³/sec. Its mean annual discharge at the Irklinskiy is 39 m³/sec. At present the hydraulic conditions of the Ural River are improved by the Irklinskiy Reservoir with the capacity of more than one billion cu m. The Irklinskiy Hydroelectric Power Plant is now under construction (Table III).

Other Ural Mountain rivers are of secondary importance. Several small industrial power plants have been built on the Tura, Neyva and other rivers. The capacity of these plants vary between 2,000 - 5,000 kw.

IV. Rivers in the Caucasus

This chapter deals with the following rivers:

1) North Caucasus

a) Rivers flowing into the Black and Azov Seas:

Kuban' River (with Nevinnomysskiy Canal and the Belaya River)

Mzymta River

b) Rivers flowing into the Caspian Sea:

Terek River (and its tributaries Gizel'don, Ardon, and Baksan)

Sulak River (with its tributary, the Karakoysu River)

2) Transcaucasia

a) Rivers flowing into the Black Sea:

Gumista River

Inguri River

Rioni River (with its tributaries, the Ladzhanuri and Tkibuli rivers)

Bzhuzha River, a tributary of the Natanebi River

Adzharis-Tskhali River, a tributary of the Chorokh River

b) Rivers flowing into the Caspian Sea:

Kura River (with its tributaries, Khrami with Dzoraget, Iori, Alazani, Terter, and the Razdan and Vorotan, tributaries of the Araks River)

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Kuban' River-Nevinnomysskiy Canal - Bol'shoy Yegorlyk River Water System. This water system consists of the upper reaches of the Kuban' River (200-km stretch between the source and the town of Nevinnomyssk), Nevinnomysskiy Canal (which diverts water from the Kuban' River into the Bol'shoy Yegorlyk River), and the Bol'shoy Yegorlyk River. This system is fed by the waters of the Kuban' River.

The Kuban' River rises in the northern slopes of the Main Caucasian Mountain Range at an elevation 2,970 m above sea level and empties into the Temryukskiy Bay of the Azov Sea. The length of the river is 941 km; its drainage area 57,997 sq km; annual runoff 13 billion cubic meters; and the mean annual discharge 360 m³/sec. At Nevinnomyssk Kuban' waters are diverted through the Nevinnomysskiy Canal into the Bol'shoy Yegorlyk River. In winter most of the Kuban' water is diverted into this canal, leaving in the Kuban' River the flow of only some 3 m³/sec.

Nevinnomysskiy Canal connects the Kuban' and the Bol'shoy Yegorlyk Rivers. It starts at the town of Nevinnomyssk on the Kuban' River and ends at the Novo-Troitskaya Stanitsa (Novotroitskoye) on the Bol'shoy Yegorlyk River. The canal is 49.2 km long, 35 m wide, 13 m deep, and is rated for the discharge of 75 m³/sec, the mean annual discharge being 54 m³/sec (in winter the flow is estimated at 10 to 20 m³/sec).

The Bol'shoy Yegorlyk River is a left tributary of the Zapadnyy Manych River, which is a left tributary of the Don River.

It rises in the Stavropol' Highland and flows through arid steppes into the Manych River. The Bol'shoy Yegorlyk River is 388 km long; its drainage area is 15,098 km². It carries water only during the spring flood and fall rain seasons. In other seasons it is fed almost exclusively by the Kuban' River waters through Nevinnomysskiy Canal.

The Kuban' River proper presents very little interest from the point of view of hydropower development. However, one 1957 source stated that the construction of the Krasnodar Hydroelectric Power Plant on Kuban' River would probably start during the sixth five-year-plan period.

Two hydroelectric power plants, the Svistukhinskaya and Sengileyskaya stations, are built on the Nevinnomysskiy Canal (Incl. 5 and Table IV) and the Novo-Troitskaya Station is built at the entrance from the Nevinnomysskiy Canal to the Bol'shoy Yegorlyk River (Table IV). Three hydroelectric power plants are planned on the Bol'shoy Yegorlyk River. The construction of the first of these stations, the Yegorlyk Station No. 1, (Table IV), has already been started in 1956.

The Belaya River, a left tributary of the Kuban' River, rises at the Fishta and Oshtepa mountain peaks at the northern slope of the Main Caucasian Mountain Range. It flows through Krasnodarskiy kray, RSFSR. The river is 229 km long; its drainage area is 6,160 sq km; its total fall is 2,283 m (which is about 10 m per 1 km); and its annual runoff (measured at Maykop) is 1,750 million cu m. The hydrological and geological conditions of the upper reaches of the river are favorable for the construction of a series of hydroelectric power plants.

It is estimated that a series of 13 hydroelectric power plants with a combined annual output of 2.1 billion kwhr can be built on the Belaya River. Of these stations, the Maykop and Belorechenskaya stations are already in operation

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and the construction of the third station, the Dekhovskaya, has started some-time during the sixth five-year plan period (1956-1960) (Incl. 5 and Table IV).

The Mzymta River rises in the southern slopes of the Main Caucasian Mountain Range at an elevation 3,000 m above sea level. It flows through Krasnodarskiy kray, RSFSR, and empties into the Black Sea at the town of Adler. The river is 82 km long, its drainage area is 885 sq km, and its annual runoff (at Krasnaya Polyana) is 915 million cu m. At present there is one hydroelectric power plant, the Krasnaya Polyana Station, on the river (Incl. 5 and Table IV).

The Terek River rises in the Zilginskaya SSSR of the Main Caucasus Mountain Range (Gruzinskaya SSR) and flows into the Caspian Sea forming a large delta. In its upper reaches, between the source and the city of Ordzhonikidze, the river is a typical mountain river. Its incline here is 10 m per 1 km. Downstream from Ordzhonikidze the river flows in a piedmont plain and after the inflow of the Malka River the incline of the Terek River becomes 0.15 to 0.05 m per 1 km. The length of the Terek River is nearly 600 km; its total fall more than 2,500 m; the drainage area 43,700 sq km; and the mean annual discharge, at the Kazbegi Village 23.40 m³/sec, at Ordzhonikidze 36.05 m³/sec, at El'khotovo Village 120.00 m³/sec, at Chernoyarskaya Village 247.00 m³/sec, and at the mouth 350 m³/sec.

A 148-km long Terek-Kuma irrigation canal built between the Terek River (18 km upstream from the town of Mozdok) and the Kuma River (at Pravokumskaya Village) diverts some of the Terek water for irrigation purposes. The first stage of the canal draws as much as 100 cu m/sec.

In 1936 the Gidroeenergoprojekt (All-Union Trust for the Design and Planning of Hydroelectric Power Plants and Hydroelectric Developments) has worked out an overall plan for the development of the Terek River. According to this plan 7 reservoirs with a combined capacity of 2,542 million cu m and the following 10 hydroelectric power plants with a combined capacity of 494,000 kw could be built on the section of the Terek River between the source and the El'khotovo Village: Kobi (17,000 kw); Andezit (24,000 kw); Dar'yal (220,000 kw); Dlinnaya Dolina (51,000 kw); Chernorechenskaya (19,000 kw); Ordzhonikidze (18,000 kw); Delakovskaya (18,000 kw); Tsalykskaya (7,000 kw); Kardzhinskaya (20,000 kw) and El'khotovo (100,000 kw). A little downstream from the El'khotovo Village some of the Terek water could be diverted by means of a canal into the dry right tributary of the Terek River, the Krup River. On this River a series of six hydroelectric power plants with a combined capacity of 240,000 kw could be built. The Krup power plants would be regulated by the El'khotovo Reservoir.

At present there are two power plants, the Ezminskaya and Ordzhonikidze stations, in operation on the Terek River. The third station, Dar'yal, is under construction (Incl. 5 and Table IV). Of these three stations, the construction of the Ordzhonikidze and Dar'yal were included in the 1936 plan described above.

It is not clear whether the Ezminskaya Station is intended to replace the Dlinnaya Dolina or Chernorechenskaya or both stations called for in the 1936 plan.

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The Gizel'don River, left tributary of the Terek River, rises in the Dzhimarey-Khokh and Shan-Khokh glaciers in the northern slope of the Main Caucasian Mountain Range. The Gizel'don is a typical glacier-fed river with summer floods and winter dry seasons. The discharge (at the Verkhnyaya Koban' Village) fluctuates between $0.7 \text{ m}^3/\text{sec}$ and $27 \text{ m}^3/\text{sec}$. The mean annual discharge is $3.35 \text{ m}^3/\text{sec}$. The maximum flood discharge, observed, was $45 \text{ m}^3/\text{sec}$. The average annual runoff (measured at the Verkhnyaya Koban' Village) is 106 million cu m.

At present there is one hydroelectric power plant (Gizel'don) in operation on the Gizel'don River (Incl. 5 and Table IV).

Ardon River, a left tributary of the Terek River, is a swift mountain river. It flows in Severo-Osetinskaya ASSR. The Ardon River is 95 km long and its drainage area is $2,120 \text{ km}^2$. In 1937, one hydroelectric power plant, the Nuzal'skaya station, was under construction on the Ardon River. The projected capacity of this station was 14,000 kw. It was scheduled for completion in 1941. It was reported, however, in a 1939 source that the construction of this station was interrupted. There is no information that it was ever resumed.

The Baksan River is a right tributary of the Malka River, which, in turn, is a left tributary of the Terek River. The Baksan River rises in the northern slopes of the Main Caucasian Mountain Range (Azau Glacier of the Elbrus Mountain). It is 165 km long and has a $6,880 \text{ sq km}$ catchment area. As a typical glacier-fed mountain river it is characterized by summer floods and winter low-water periods. The average yearly runoff is $1,030,000,000 \text{ cu m}$; the mean annual discharge is 33.2 cu m/sec . There is a power plant, the Baksan Station, on the Baksan River (Incl. 5 and Table IV).

The Sulak River and its Tributary, the Karakoysu River. The Sulak River is formed by the confluence of the Avarskoye Koyasu and the Andiyaskoye Koyasu rivers, which rise in the glaciers of the north-western slopes of the Main Caucasian Mountain Range. It flows into the Caspian Sea forming a large delta. The length of the river from the source of the Andiyaskoye Koyasu is 332 km. The length of the Sulak River proper is 150 km; the drainage area is $13,400 \text{ km}^2$; mean annual discharge $180 \text{ m}^3/\text{sec}$; the flow fluctuates from $35 \text{ m}^3/\text{sec}$ to $2,500 \text{ m}^3/\text{sec}$. The Sulak River forms many canyons and gorges (the main Sulak Canyon at the confluence of the Avarskoye and Andiyaskoye Koyasu; the Cherkey and Miatlinskoye Gorges, each about 800 m deep; and the Akhatlinskoye Gorge about 150 m deep). The hydropower resources of the Sulak River and its tributaries are very rich. According to a plan, developed in 1932-1933, it is possible to build on the Sulak River and its tributaries about 10 hydroelectric power plants with a combined capacity of 950,000 kw and three reservoirs (on the Andiyaskoye Koyasu, Avarskoye Koyasu and the Sulak River proper). The Sulak River can be completely regulated assuring a steady discharge of $145 \text{ m}^3/\text{sec}$.

At present there is one hydroelectric power plant, the Chir-Yurt Station, under construction on the Sulak River proper (Incl. 5 and Table IV). Construction of another power plant, the Cherkeyskaia Station, will start on the Sulak River as soon as the Chir-Yurt Station is put in operation. Another power plant, the Gergebil' Station (Table IV), is in operation since 1937 on the Karakoysu River, a left tributary of the Kazykumukhskoye Koyasu, which is a right tributary of the Avarskoye Koyasu. The Karakoysu River is 100 km long, its catchment area is $1,800 \text{ sq km}$, and its mean annual discharge is $20 \text{ m}^3/\text{sec}$.

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The Gumista River is formed by the confluence of two rivers, the East Gumista and the West Gumista. It flows into the Black Sea. The East Gumista River rises in the Bzyb'skiy Spur of the Main Caucasian Mountain Range at an elevation 2,670-m above sea level; it is 31 km long, its catchment area is 117 sq km, and the mean annual discharge (at the Sukhumi Dam) 7.78 m³/sec. The West Gumista River is 26 km long. The East and West Gumista Rivers are separated by a high Otsyush Mountain Ridge. In their middle course they flow only 2.5 to 3 km apart, the East Gumista flowing at an elevation 270 m higher than the West Gumista River. After their confluence, the river is called Gumista. This section of the river is 12 km long.

The difference in elevations (270 m) of the East and West Gumista Rivers has been utilized in constructing the Sukhumi Hydroelectric Power Plant, the head-works of which were built on the East Gumista River and the powerhouse on the West Gumista River (Incl. 5 and Table IV).

The Inguri River is located in the western part of the Gruzinskaya SSR. It starts in a 2,614-m high glacier area of the Main Caucasian Mountain Range and flows into the Black Sea. The length of this rapid mountain river is 188 km and the catchment area is 3,730 sq km. A 1958 source states that it would be desirable to build a hydroelectric power plant on the Inguri River (Incl. 5). It was proposed to complete its construction not later than in 1966. This power station is planned as one of the largest in Gruzinskaya SSR.

The Rioni River, rises in one of the main glaciers on the southern slope of the Main Caucasian Mountain Range and empties into the Black Sea. It is 316 km long, the drainage area is 13,500 sq km, and the mean annual discharge is 430 m³/sec. The average annual runoff is estimated at 3,940,000,000 cu m. From the source to the city of Kutaisi the Rioni River is a typical mountain stream.

It is estimated that about 12 hydroelectric power plants could be built on the Rioni River. At present, the Rioni River development consists of the following three stations: the Gumati Ges I, the Gumati GES II, and the Rioni GES (Incl. 5 and Table IV). In addition to the above power plants, the Namakhvani Plant (probably near Namakhvani Village, 25 km from Kutaisi) is planned for construction on the Rioni River. The possibility of the construction of the Vartsikhskiy power plants is mentioned. The output of the Gumati and Rioni power plants will be considerably increased after the construction of the Ladzhanuri Plant on the Ladzhanuri River (tributary of the Rioni River).

The Ladzhanuri and Tskhenis-Tskali Rivers. The Tskhenis-Tskali River is the largest right tributary of the Rioni River. It originates in the glaciers of the southern slope of the Main Caucasian Mountain Range. The river is 159 km long and its drainage area is 2,180 sq km. In its upper section, the river is a typical mountain stream. The Ladzhanuri River is also a right tributary of the Rioni River, but it is shallow and its flow is not sufficient for the operation of a large hydroelectric power station. At present, the flow of the Tskhenis-Tskali River is diverted through a series of tunnels into the Ladzhanuri River, where the Ladzhanuri Hydroelectric Power Plant is under construction (Incl. 5 and Table IV).

The Shaori and Tkibuli Rivers. Both rivers are small mountain streams located in Gruzinskaya SSR. The Shaori flows into the Tkibuli River, a tributary of the Kvirila River which, in turn, is a left tributary of the Rioni River. Flowing through the Nakeral'skiy Ridge of the Main Caucasian Mountain Range,

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the Shaori River forms a deep gorge. This gorge has been dammed and a reservoir with storage capacity of some 30 to 35 million cu m has been formed. This reservoir feeds the high-head Shaori Hydroelectric Power Plant (Table IV), which is the upper power plant of the Shaori-Tkibuli development. The lower power plant of the development is the Tkibuli Station (Incl. 5 and Table IV), built on the Tkibuli River.

The Bzhuzha River is a tributary of the Natanebi River, which empties into the Black Sea somewhere between Poti and Batumi cities. The Bzhuzha Hydroelectric Power Plant, connected to the system of the Georgian Regional Power Administration, is built on the Bzhuzha River. (Table IV)

The Adzharis-Tskhali River, the main (right) tributary of the Chorokh River, rises in the western slopes of the Arslanskiy Mountain Range. It flows from east to west, crossing the entire Adzharskaya ASSR. The Adzharis-Tskhali valley narrows down in places to gorges and canyons, but on the whole it is a rather wide river.

On this river the Adzharis-Tskhali Hydroelectric Power Plant (Atsges) is in operation since 1937 (Table IV).

The Kura River is the largest river in Caucasus. It rises in Turkey, 2,700 m above sea level. In the Soviet Union, it flows through Gruzinskaya SSR and Azerbaydzhanskaya SSR and empties into the Caspian Sea. The Kura River is 1,515 km long and has a catchment area of 188,000 sq km. The average annual runoff is 6,000 mill cu m (at Tbilisi) and 12,125 mill cu m (at Mingechaur), and the mean annual discharge is 180 to 252 m³/sec (at Tbilisi), 376 m³/sec (at Mingechaur), and 580 m³/sec (at the mouth). In its upper reaches (between the source and Tbilisi) the river flows through ridges of the Main Caucasian Mountain Range and of the Southern Caucasian Plateau. Below the Mingechaur Rapids the river flows through the Kura-Araks Lowland.

The Kura River power development consists of the following six hydroelectric power plants: Chitakhevi, Zemo-Avchaly, Ortachaly, Akstafa, Mingechaur, and Varvara (Incl. 5 and Table IV).

The Khrami River is a right tributary of the Kura River. It rises in the southern slope of the Trialetskiy Mountain Ridge at an altitude 2,422 m above sea level. The river flows in Gruzinskaya SSR, entering the Azerbaydzhanskaya SSR in its lower reaches. The Khrami River is 196 km long and its drainage basin is 8,342 sq km. The minimum discharge of the river is 2.5 m³/sec, the maximum discharge 200 m³/sec, and the mean annual discharge 9.3 m³/sec.

One hydroelectric power plant (Khrami I) is in operation since 1947 (Incl. 5 and Table IV) and another plant (Khrami II) is under construction (Incl. 5 and Table IV) on the Khrami River.

The Dzoraget River forms together with the Bembakget River the Debetaget River which is a right tributary of the Kura River. The Dzoraget River flows in Armyanskaya SSR and has a catchment area of 1,460 sq km. There are low water periods in the winter and sudden torrential rains in the spring. The mean annual discharge is 16 m³/sec (the maximum flow is 600 m³/sec).

The water of the Dzoraget River is utilized by the Dzoraget Hydroelectric Power Plant (Incl. 5 and Table IV). The dam of this power plant is located on the Dzoraget River and the powerhouse on the Debetaget River. Another power plant, the Shnokhsakaya Station, is planned for construction on the

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Debetaget River in the near future.

The Iori River is a left tributary of the Kura River. Its water is utilized for the irrigation in the summer and for the power production in the winter. For this purpose an extensive system of irrigation canals and reservoirs, the Samgori Irrigation System, has been built. One high dam with a hydro-power station was planned in 1952 for construction on the Iori River at the Sioni Village. Another three hydroelectric power plants were planned for construction on the Upper Main Canal of the Samgori Irrigation System at the Satskhanisi, Mantkobi, and Tetrikhevi villages. The combined capacity of these four power plants was estimated at 36,000 kw. One 1957 source reported that the Samgori hydroelectric power plants were put into operation in 1952 and started to operate at full capacity in 1954.

The Alazani River is a left tributary of the Kura River. It is 410 km long and has a catchment area of 16,900 sq km. Part of the river is diverted into the Alazan Irrigation Canal which runs in the same direction and falls into the river at the lower course. At this canal the 7,000-kw Alazan Hydroelectric Power Plant was built in 1937.

The Terter River is a right tributary of the Kura River, is 171 km long and has a catchment area of 3,400 sq km. Its mean annual discharge is 24.60 m³/sec.

It was planned in 1932 to exploit the water capacity of Terter River in a series of power plants with combined capacity of 130,000 kw and annual output of 650 million kwhr. A 1936 source names three power plants of this series: Terter No. 1 (56,000 kw), Terter No. 2 (48,000 kw), and Terter No. 3 (14,000 kw). Of these power plants only the construction of the Terter No. 2 power plant started in 1934 in the region of the city of Kirovabad (Gandzha). But the dam of this power plant collapsed due to faulty design and it was decided to build the Terter No. 2 plant at Madagiz village, now known under the name Madagiz Hydroelectric Power Plant. It was put into operation in 1945.

The Razdan River (Zanga River) flows out of Lake Sevan and discharges into the Araks River, the right tributary of the Kura River. Lake Sevan is located high in the mountains at an elevation of 1,914 m above sea level. It has a surface area of 1,400 sq km and holds more than 58.5 billion cu m of water. About 30 rivers flow into the lake and only one river, the Razdan River, flows out of it. The Razdan River is 146 km long and has a total fall of 1,089 m. Its drainage area including the Lake Sevan covers 7,310 sq km. Its annual runoff is about 100 million cu m. At present, the following power plants are in operation on the Razdan River: Sevan, Gyumish, Arzni, Kanakar, Yerevan I, and Yerevan II (Table IV). The Atarbekyan and the Yerevan power plants are under construction (Table IV). According to various recent sources two or three more hydroelectric power stations are planned for construction on the Razdan River, below the city of Yerevan.

The Vorotan River (called also Bazar-Chay) is a left tributary of the Araks River which, in turn, is a right tributary of the Kura River. The Vorotan River flows from a lake, located 3,000 meters above sea level in the Zangezur Mountains. It flows through Armanakaya SSR and Azerbaydzhanakaya SSR and empties into the Araks River. Its length is 159 km and the drainage area about 2,980 sq km.

It is planned to build a series of 8 hydroelectric power plants on this river. Construction of the Tatevskaya Station (Incl. 5 and Table IV), the largest of

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these stations is scheduled to start by the end of the sixth Five-year Plan. The projected capacity of Tatevskaya Hydropower Plant was estimated from 100,000 kw to 160,000 kw.

V. Rivers of Central Asia and Kazakhstan (excluding Irtysh River Basin)

This chapter deals with the following rivers:

Rivers of the Aral Sea Basin:

the Amu-Dar'ya River and its tributaries, the Vakhsh and Varzob rivers; the Syr-Dar'ya River and its tributaries, the Naryn, Kara-Dar'ya and Chirchik rivers.

Rivers of the Lake Balkhash Basin:

the Ili River and its tributary, the Bol'shaya Almaatinka River.

Rivers which disappear in sands:

the Zeravshan River and the Chu River.

Rivers of the Aral Sea Basin

The Amu-Dar'ya River and Kara-Kum, Main Turkmen, and Shavat Irrigation Canals

The Amu-Dar'ya River (known in its upper reaches as the Pyandzh R.) rises in the Hindukush Mountains (Afghanistan) and empties into the Aral Sea. It is 2,540 km long, its drainage area is 227,000 km², average annual discharge at the town of Kerki is 66 billion cu m and at the estuary 42.05 billion cu m (Ten billion cu m are used for irrigation, the rest is lost through evaporation and absorption). At present the hydropower resources of the Amu-Dar'ya River are not utilized. One 1957 source states, however, that three hydropower plants with a combined capacity of 1,500,000 kw could be built in the upper section of the river (above the town of Kerki), several power plants with a combined capacity of 300,000 kw could utilize the section of the river between the towns of Kerki and Chardzhou (these power plants are contemplated in connection with the Amu-Bukhara and Kara-Kum irrigation systems), and, finally, two power plants -- the 100,000-kw Daya-Khatyn and 120,000 to 150,000-kw Tuyu-Myun -- could be built in the section of the river between the town of Chardzhou and the Aral Sea. It is estimated that several hydroelectric power plants could be built on the 900-km long Kara-Kum Irrigation Canal, which is presently under construction. The canal will be 4-4.5 m deep and 50-150 m wide. One of the stations, the Kara-Kum Hydropower Plant, is proposed to be built in the middle of the first section of the canal (between the Bossag Village on the Amu-Dar'ya River and the town of Mary on Murgab River). Three hydroelectric power plants with a combined capacity of 100,000 kw are proposed for construction on the Main Turkmen Canal, which is also under construction. It will stretch between the Amu-Dar'ya River (near the town of Nukus) and the Caspian Sea. The canal will be 1,000 km long, its ultimate flow will be 600 m³/sec. Two of the above-mentioned power plants will be built on the canal and one on the Amu-Dar'ya River at the Takhia-Tash Dam. One hydroelectric power plant, the Shavat Station, was under construction in 1947 on the Shavat Irrigation Canal which leads through the city of Urgench. There is no further information on this power plant.

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The Vakhsh River is a right tributary of the Pyandzh River. Both rivers form the Amu-Dar'ya River. Vakhsh rises in the northern slopes of the Zaskay Mountains. Its total length is 690 km, the drainage area approx. 40,000 sq km, and the average annual runoff about 20 billion cu m. The water flow varies between 150 m³/sec and 4,000-5,000 m³/sec, the average annual discharge (near Kurgan-Tyube) being 645 m³/sec.

At present, the Golovnaya Hydroelectric Power Plant (Incl. 5 and Table V) is under construction on the Vakhsh River and the Perepadnaya Station (Incl. 5 and Table V) is under construction on the Vakhsh Irrigation Canal, which draws water from the Vakhsh River. In connection with the construction of the Perepadnaya Station, the Vakhsh Canal was widened and its flow increased from 90 to 150-180 m³/sec. One 1957 source mentioned that it is possible to build a series of hydroelectric power plants with a combined capacity of 1,656,000 kw on the 140-km long stretch of the Vakhsh River between the Nurekskaya Bend and the headworks of the Vakhsh irrigation system. This stretch has a head of 315 m. Two of these stations were specifically named as Nurekskaya GES I (900,000 kw) and Nurekskaya GES II (233,000 kw).

The Varzob River, also called Dyushambe-Dar'ya, falls 10 km south of Stalinabad into the Kafirnigan River, which is a right tributary of the Amu-Dar'ya River. The Varzob rises in the Gissarskiy Mountain Range. It is 97 km long; its entire fall is 3,088 m; the average yearly flow (at the Varzob Power Development) is 44.5 m³/sec (the maximum observed flow was 1,000 m³/sec); and the yearly runoff is 1.4 billion cu m.

The hydropower resources of the Varzob River are utilized by three hydroelectric power plants, the Varzob I, Varzob II, and Varzob III (Table V).

The Syr-Dar'ya River is formed by the confluence of Naryn (77% of flow) and Kara-Dar'ya (23% of flow) rivers, which begin in Tien-Shan Mountains. It flows into the Aral Sea. The length of the Syr-Dar'ya River from the confluence of Naryn and Kara-Dar'ya rivers is 2,206 km and including the length of Naryn River -- 2,982 km. The drainage area is about 462,000 sq km and the average annual runoff 14 cu km. The mean annual discharge at the point where it emerges from the mountain ridge is 600 m³/sec. It discharges into the Aral Sea only 430 m³/sec, the balance being lost through evaporation and absorption while the river flows through the desert region.

At present, there are two hydropower plants in operation on the Syr-Dar'ya River -- the Kayrak-Kum and the Farkhad stations (Incl. 5 and Table V). There is also one hydropower station at the Kzyl-Orda Dam, used mostly for local and irrigation purposes and one station (ultimate capacity 12,500 kw) on the Arys'-Turkestan canal irrigation system. Another two power plants are planned for construction between the Farkhad and Kzyl-Orda dams. The first of these stations, the 40,000-kw Golodnostepakaya Station, is proposed for construction after 1962 on the Canal im. Kirov, and the other station is proposed for construction at a later date at Chardara. Both stations will be used for local needs and irrigation purposes.

The Naryn River, a right confluent of the Syr-Dar'ya River, rises in the Tien-Shan Mountains. It contributes 77% of the total flow of the Syr Dar'ya River, emptying into it at the rate of 400 m³/sec. The Naryn is 723 km long and its drainage area is 59,600 sq km. The average runoff exceeds 13 billion cu m.

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The Naryn River feeds the Northern Fergana Irrigation Canal (180 m³/sec) and partly (110 m³/sec) the Great Fergana Irrigation Canal (the Great Fergana Irrigation Canal receives the balance of its flow from the Kara-Dar'ya River). The Naryn River is characterized by a great fall (on the average 3 m per 1 km) and by geological conditions, favorable for the construction of hydroelectric power plants (rocky formation of banks, deeply set bed, etc.). According to preliminary data, more than 20 high-head hydroelectric power plants with a combined capacity of 4 million kw could be built on the Naryn River and its tributaries. So far, the Uch-Kurgan No. 1 Hydroelectric Power Plant is under construction on the Naryn River and Namangan No. 1 and Namangan No. 2 stations are in operation on the Northern Fergana Canal (Table V). The following power plants are mentioned in 1957 and 1958 sources as projected for construction in foreseeable future on the Naryn and on the Susamyk rivers (the Susamyk River is a tributary of the Kokomeren River which is a tributary of the Naryn River):

the Alabuginakaya (550,000 kw), Toguz-Kurgan (550-600,000 kw), Tash-Kumyr (planned as the largest on Naryn), and the Uch-Kurgan No. 2 (30,000 kw) stations on the Naryn River and the Susamyk Station on the Susamyk River.

In 1947 a high importance was attached to the construction of Uychi No. 1 and Uychi No. 2 hydroelectric power plants on the Northern Fergana Irrigation Canal. However, information is not available whether these stations were ever built. Each of these stations was to be equipped with 3 Francis turbines, each rated for the discharge of 50 m³/sec. The head at station No. 1 was to be 16.6 m and at station No. 2 -- 37.0 m. It was also planned in 1947 to build the Kassansay Power Plant and Namangan No. 3 and Namangan No. 4 stations.

The Kara-Dar'ya River is a left confluent of the Syr-Dar'ya River. It is 316 km long and its drainage area is 27,800 sq km. It has no importance from the point of view of power production. However, it feeds the Shaarikhan-Say Irrigation Canal on which 3 hydroelectric power plants, the Shaarikhansay 0, Shaarikhansay 6, and Shaarikhansay 7, are built (Incl. 5 and Table V).

The Chirchik River is a right tributary of the Syr-Dar'ya River. It is formed by the confluence of Psken and Chatkal rivers. Its length is 336 km (including Chatkal) and 155 km without it. Its drainage area is 14,200 sq km. After the confluence with Chatkal River, the Chirchik River has a flow varying from 30 to 1,452 m³/sec. When the flow reaches 600 m³/sec, the amount of floating silt is 1,000 tons per day. The mean annual discharge is 350 m³/sec. In summer, when hot dry winds blow from the south, the flow decreases considerably. The average winter flow in the Chirchik River is 60 m³/sec. High water occurs twice a year, in April-May and in July, when countless small creeks carry water and silt into the Chirchik River. Frazil and anchor ice caused considerable trouble in winter. Chirchik River feeds water to the Boz-Su Irrigation Canal. At present the Chirchik -- Boz-Su hydropower development consists of the following stations:

Tavakskaya, Komsomol'sk, Troitskaya (Ak-Kavak I-bis), Ak-Kavak I, Ak-Kavak II, Ak-Kavak III (Kibray), Kadyr'ya, Salar, Boz-Su, Shaykhantaur, Burdzhaz I, Burdzhaz II, Ak-Tepe, Lower Boz-Su I, Lower Boz-Su II, Lower Boz-Su III, Lower Boz-Su IV, Lower Boz-Su V, and Lower Boz-Su VI, (Table V). There is a certain confusion in respect to the Troitskaya Power Plant. Its construction started before the war, but it was later interrupted. One 1948 source mentioned it as under construction. No further information is available on

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this plant.

In addition to the above-mentioned stations, it is planned to build the following stations in the upper reaches of the Chirchik River (upstream from Tavakakaya Station): the Charvak, Khodzshikent, and the Gazalkent stations. The Upper-Chatkal and the Middle-Chatkal stations are also mentioned as possible for construction on the Chatkal River.

Rivers of the Lake Balkhash Basin

The Ili River rises in Central Asian Mountains in China where it is formed by the confluence of the ~~Yenisey~~ and Kungey rivers. It empties into Lake Balkhash. The total length of the Ili River (from the source of the Tekes River) is 1,400 km. The length of the Ili River proper is 950 km and its length within the Soviet Russia is 740 km. The total drainage area is 131,500 sq km, and the drainage area within the Soviet Russia is approximately 740 sq km. The mean annual discharge is 400-450 m³/sec. The maximum flow in high-water periods reaches 2,900 m³/sec.

According to one 1956 source, the hydropower resources of the Ili River basin are estimated at 37 billion kwhr of which less than 1% are now utilized. The sixth five-year plan provides for the construction on the river of the Kapchagayakaya Station (Incl. 5). This hydroelectric power plant will be built at the Kapchagayakaya Gorge, 70 km downstream from Alma-Ata and 11 km downstream from the Ili settlement. The ultimate capacity of this power plant is yet unknown.

The Bol'shaya Almaatinka River is a tributary of the Kaskalen River, which, in turn, is a tributary of the Ili River. The Bol'shaya Almaatinka River originates in the glaciers of the Zailiyskiy Ala-Tau Mountain Range. Twelve kilometers from the source it flows through Lake Alma-Ata, which is 36 m deep and has a surface area of 0.5 sq km. Its mean annual discharge is 1.89 m³/sec with mean for the month of March being 0.59 m³/sec and mean for August 5.69 m³/sec. The minimum flow is 0.5 m³/sec and the maximum flow reaches 7 m³/sec during the melting of glaciers and 12 m³/sec during torrential rains.

A series of small-capacity hydroelectric power plants have been built on the Almaatinka River on the 42-km stretch between Lake Almaatinskoye (2,500 m above sea level) and the city of Alma-Ata (700-900 above sea level) (Table V).

Rivers which disappear in sands.

The Zeravshan River rises in glaciers of the Zeravshan Ridge of the Alayskiy Mountain Range in Tadzhikskaya SSR. It flows toward the Amu-Dar'ya River and disappears in the sands 20 km before reaching the Amu-Dar'ya. It is 738 km long; its drainage area is 41,860 sq km and its annual runoff is about 5.2 cu km. Its flow varies from 30-35 m³/sec in winter to 600-700 m³/sec in the summer. In its upper reaches (300 km long) the Zeravshan is a turbulent mountain river. After entering the desert in Uzbekakaya SSR, it does not receive any tributaries and gradually loses its water through irrigation, evaporation and absorption. The Zeravshan River feeds the Dargom Irrigation Canal. The water intake of the Dargom Canal is at the Ravat-Khodzshinskaya Dam. The average water flow in the canal (at the Khishrau Station) is 25 m³/sec in December through April, 45 m³/sec in June through November, and 19 m³/sec in May.

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One 1957 source estimates the hydropower resources of the Zeravshan River at 2,205,000 kw. However, at present, there is only one municipal hydroplant known to be in operation on this river in the city of Pendzhikent. According to the same 1957 source, the following power plants are proposed for construction on the Zeravshan River: one power plant (several scores of kv) at the Ravat-Khodzhinskaya Dam; the 100,000-kw Pendzhikent Station; 40,000-kw Dupulinakaya; 70,000-kw Yavanakaya; Iskanderkul'skaya; Zakhmatabadakaya, and Bishkentskaya stations.

The following power plants are built on the Dargom Irrigation Canal: Khishrau (Incl. 5 and Table V), Taligulyan No. 1, Taligulyan No. 3, Kakhraman and, probably, Taligulyan No. 2 stations. The capacity of the Taligulyan stations is not known. Probably they are small agricultural power plants. One 1957 source states that the next station to be built on the Dargom Canal would be the 100,000-kw Samarkand Hydroelectric Station and after the reconstruction of the intake of the Dargom Canal one or two stations with single or combined capacity of 100,000 kw.

The Chu River is formed by the confluence of the Dzhuvanaryk and Kochkor rivers which rise in the Central Tien-Shan Mountain Range. It flows between the Lake Balkhash and Syr-Dar'ya River and terminates in the sands of the Muyn-Kum Desert. The river is 1,030 km long; its drainage area is 27,000 sq km, and the mean annual discharge (below the city of Tokmak) is 57 m³/sec. The flow of the river is regulated by the Orto-Tokoy Reservoir, 14 km long and 4 km wide. The Chu River feeds the Great Chu, Atbashinskiy, and the Georgiyevskiy irrigation canals. The Great Chu Canal originates at a small village of Kanbul' near Tokmak, Frunzenskaya o., Kirgizskaya SSR, some 140-150 km downstream from the dam of the Orto-Tokoy Reservoir. It consists of 2 parallel canals -- the 175-km long West Chu and the 120-km long East Chu canals. The Atbashinskiy and Georgiyevskiy irrigation canals branch off from the Chu River at the Chumish Dam, some 8 km from the Georgiyevskoye (Georgiyevka) Village, Dzhambul'skaya o., Kazakhskaya SSR.

There are no hydroelectric power plants on the Chu River yet. However, 3 power plants -- two at Dzhil'-Aryk (Incl. 5) and one at Tokmak City -- are proposed for construction. Nine small-capacity power plants have been built on the West Chu Canal (Table V), two small stations, the 410-kw Malaya Alamedinskaya and 4,400-kw Atbashinskaya Station have been built on the Atbashinskiy Canal and one station, the 6,400-kw Georgiyevskaya Station on the Georgiyevskiy Canal.

VI. Rivers in Siberia and Soviet Far East

This chapter deals with the following rivers: Ob', Irtysh, Ul'ba, Yenisey, Angara, Amur (with its tributaries), Lena, and Namakan.

The Ob' River, with its major left tributary the Irtysh River, is the main water artery in Western Siberia. It is formed by the confluence of Katun' and Biya rivers, which rise in Altay Mountains at an elevation 4,000 m above sea level. It empties into the Gulf of Ob' (Obakaya Guba) of the Kara Sea.

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The main hydrological data of the Ob' River are:

Length -- 3,680 km (from the confluence of Katun' and Biya rivers to the mouth)
 -- 5,570 km (from the source of the Irtysh River to the mouth)
 drainage area -- 2,930,000 sq km
 annual runoff -- 394 cu km
 mean annual discharge -- 12,300 m³/sec

discharge at individual points:

at Barnaul	9,700 m ³ /sec (max)	360 m ³ /sec (min)
at Novosibirsk	15,000 " "	650 " "
at Salekhard	42,800 " "	2,000 " "

In its upper reaches, the Ob' River flows through the Altay Mountains region. Downstream of the city of Kamen-na-Obi (Kamen'-on-Ob'), the Ob' River enters the Western Siberian Plain.

One 1956 source estimates the power resources of the Ob' River to be about 5.7 million kilowatt.

At present the 400,000-kw Novosibirsk Hydroelectric Power Plant is under construction on the Ob' River at Novosibirsk (Incl. 5 and Table VI). It is expected to start operating at full capacity by the beginning of 1959. The second station on the Ob' River will be the 630,000-kw Kamenskaya Hydroelectric Power Plant (Incl. 5 and Table VI), located near the city of Kamen'-na-Obi, 200 km upstream from Novosibirsk.

The following six hydroelectric stations are envisaged for construction on the Ob' River below Novosibirsk: Baturinskaya (near Baturino), Kireyevskaya, Ohulynskaya (at Ohulya R.), Tymkaya (at Tym R.), Vakhskaya (at Vakh R.), and Nizhne-Ob'skaya (Lower Ob') (10 km from the city of Salekhard).

Some upper tributaries of the Ob' River have been roughly surveyed. Several hydroelectric power plants could be built on the Katun' River (mean annual discharge -- 630 m³/sec). Of all tributaries of the Ob' River only the Irtysh River is already utilized for power production.

The Irtysh River is the main tributary of the Ob' River. It has its source in China, at the southwestern slopes of the Mongolian Altay. It flows for 580 km within the borders of China; 170 km within the Soviet territory, it flows through Lake Zaysan (380 m above sea level). The section of the river from its source to Lake Zaysan is called "Chernyy Irtysh" (Kara-Irtysh), the section from Lake Zaysan to the mouth -- "Belyy Irtysh" or simply Irtysh.

The main hydrological data of the Irtysh River are:

Total length (from the source to the mouth) 4,422 km

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Name of Power Plant	Average Head m	Installed Capacity 1,000 kw	Average Annual Output mill kw-hr
Donakaya	12.2	110	600
Shul'ba (Shul'binskaya)	53.9	500	3,260
Semipalatinsk	19.5	200	1,170
Belokamenskaya	26.7	250	1,680
Izvestkovskaya	11.7	110	730
Akzharskaya	10.7	90	610
Podpuskovskaya	11.8	100	600
Yazyshenskaya	14.5	120	900
Pavlodar	9.3	100	500
Bobrovskaya	15.6	120	840
Omsk	15.4	150	860

Of these stations only the Shul'ba Power Plant (Incl. 5 and Table VI) can be now considered as feasible for construction. Its construction would probably begin after the completion of the construction of the Ust'-Bukhtarma Station. In addition to the above 11 stations, the following three power stations are envisaged for construction downstream from the city of Omsk: the Taraskaya, Ishinskaya and the Tobol'skaya stations.

The Ul'ba River, a right tributary of the Irtysh River, is formed by the confluence of the Tikhaya and Gromotukha rivers. Its is 148 km long, counting from the source of the Gromotukha River. Its drainage area is 7,400 sq km and the average water discharge, measured near the Ul'ba settlement, is 14.2 m³/sec.

There is one hydroelectric power plant, the Ul'ba Station (Incl. 5 and Table VI) on the Ul'ba River. It is fed by the water of the Tikhaya River (Tikhaya River Reservoir) and partially by the water of Gromotukha River diverted to the Tikhaya River by means of a canal. In addition, there are two stations, the Upper Gromotukha (Tishinskaya) and the Lower Gromotukha stations (Table VI) on the Gromotukha River, which is regulated by the Malaya Ul'ba River Reservoir and the Levaya Gromotukha River Reservoir. There are also 3 industrial hydroelectric stations, the 3,000-kw Upper Khariuzovka, 800-kw Lower Khariuzovka, and the 600-kw Bystrukha stations, run by water of the Khariuzovka, Bystrukha and Filippovka rivers which flow into the Tikhaya River.

The Yenisey River is formed by the confluence of the Bol'shoy Yenisey and the Malyy Yenisey rivers. It empties into the Kara Sea. The Bol'shoy Yenisey River (the right confluent) flows out of Lake Kara-Balyk in the Eastern Sayan Mountain Ridge. The Malyy Yenisey River rises in the Tannu-Ola Mountain Ridge.

The Yenisey River has considerable seasonal flow fluctuations. About 40% of the annual runoff occurs during the two flood months and only 13-19% of the annual runoff occurs during the six winter months -- from November to April, inclusive.

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The main hydrological data on the Yenisey River are as follows:

Length (including the Bol'shoy Yenisey R.)	4,100 km
drainage area	2,700,000 km ²
average annual runoff	
after the inflow of Angara (Verkhnyaya Tunguska)	237 km ³
after the inflow of Podkamennaya Tunguska	306 km ³
after the inflow of Nizhnyaya Tunguska	456 km ³
at the mouth	548 km ³
mean annual discharge	
after the inflow of Angara	7,500 m ³ /sec
after the inflow of Podkamennaya Tunguska	9,700 m ³ /sec
after the inflow of Nizhnyaya Tunguska	14,500 m ³ /sec.
at the mouth	17,400 m ³ /sec.
total fall of the river	1,600 m

The flow at the Oznachennoye Village (proposed site of the Sayan Station) is 14,500 m³/sec max. and 110 m³/sec min., and the flow at Krasnoyarsk is 23,900 m³/sec max. and 340 m³/sec min.

One 1958 source estimates that a series of hydroelectric power plants with a combined capacity of 20,000,000 kw and an annual output of 120 billion kwhr can be built on the Yenisey River.

The following stations are specifically mentioned:

the 3,500,000-kw Sayan Station, proposed for construction near Oznachennoye Settlement, where the Yenisey emerges from the Sayan Mountain Range, (Incl. 5);

the Minusinsk Station, proposed for construction near Abakan, 60 km downstream from the Sayan Gorge;

the 4,000,000-kw Krasnoyarsk Station, presently under construction (Incl. 5 and Table VI);

the 6,000,000-kw Yenisey Station, proposed for construction near Abalakovo Village, 27 km below the confluence with the Angara River (Incl. 5 and Table VI);

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the 5,000,000-kw Osinovskaya Station, proposed for construction at Osinovskiy Rapids, 18 km upstream from the confluence with the Podkamennaya Tunguska River (Incl. 5).

The Lower Yenisey Station is also mentioned.

The Angara River, also called Verkhnyaya Tunguska, is the main right tributary of the Yenisey River. It flows out of the Lake Baykal and empties into the Yenisey River 2,000 km from its mouth.

The river's main hydrological data are:

length (from its source to the estuary)	- 1,854 km
catchment area (of the Angara River proper)	- 468,000 km ²
" " (including Lake Baykal)	- 1,045,000 km ²
average annual runoff	
at Lake Baykal	60.7 billion m ³
at Bratsk	92.0 billion m ³
at the estuary	124.0 billion m ³
mean annual discharge	
at Lake Baykal	1,650 m ³ /sec
at Bratsk	2,918 m ³ /sec
at the estuary	4,200 m ³ /sec
total fall of the river	380 m

The distinguishing feature of the Angara River is its uniform flow. This is due mainly to the high-regulating capacity of Lake Baykal. Lake Baykal has a surface area of 31,500 sq km and a catchment area of 590,000 sq km. The latter accounts for about 56% of the entire catchment area of the Angara River basin.

Downstream sections of the Angara River freeze up before its upper reaches. The ice forms in the vicinity of the Bratsk Power Plant in the end of October or in the beginning of November, while in the vicinity of the Irkutsk Station it forms in December. The current is very swift. These conditions account for the formation of anchor and fragile ice. In the spring the ice starts to break-up in the upper reaches of the river first. All these conditions cause severe ice jams.

In 1953 the Moscow Branch of Gidroeenergoprojekt (All-Union State Institute for Planning Hydroelectric Power Stations and Power Developments) worked out the scheme for the development of the Angara River which called for construction of the following six hydroelectric power plants on this river:

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Irkutsk	(660,000 kw),	65 km from Lake Baykal (Incl. 5 and Table VI)
Sukhovskaya	(260,000 kw),	108 km " " " (Incl. 5)
Tel'minskaya	(245,000 kw),	147 km " " " (Incl. 5)
Bratsk	(3,600,000 kw)	697 km " " " (Incl. 5 and Table VI)
Ust'-Ilinsk	(3,000,000 kw),	1,003 km " " " (Incl. 5)
Boguchany	(2,700,000 kw),	1,451 km " " " (Incl. 5)

At present the Irkutsk Station operates at full capacity and the Bratsk Station is under construction.

The Amur River and its tributaries

The Amur River is formed by the confluence of the Shilka and Argun' rivers. It empties into the Tatar Strait which connects the Okhotskoye and Japan Seas. The Amur River serves as a state boundary between the USSR and Chinese Peoples Republic. Counting from the source of the Shilka River, the Amur River is 4,554 km long and, counting from the confluence of Shilka and Argun' rivers, it is 2,846 km long. Its drainage area is 1,843,000 sq km, and the mean annual discharge at the confluence with Zeya River is 1,800 m³/sec and at the estuary 11,000 m³/sec.

The Amur River is navigable throughout its entire length. Its water flow is very irregular, (the amplitude of the fluctuation of its level is 10 to 14 m in the upper and middle sections and 6 to 7 m in the lower). During the monsoon periods the floods reach catastrophic proportions.

The Zeya River, the left tributary, is the main source of flood trouble on the Amur River. During the flood season the Zeya River discharges about 90% of its annual runoff into the Amur River at the rate of about 23,000 m³/sec (during the low season it discharges only 10 to 40 m³/sec, the mean annual discharge being 1,800 m³/sec). The problem of the flood control of the Zeya River is a very urgent one.

A joint Sino-Soviet Commission for the Development of the Amur Basin is working on the Amur River since 1954. The work of the Commission is scheduled for completion in 1959-1960. The following power plants are considered for the construction in the upper and middle sections of the Amur and on its tributaries:

On the Amur River: Amazar (about 1,000,000 kw)

Dzhalinda (about 1,000,000 kw) (Incl. 5)

Kuznetsovo (about 1,000,000 kw)

Sukhotinb

Blagoveshchensk (about 1,000,000 kw)

Poyarkovo

Khingan (about 1,000,000 kw)

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On the Argun' River:
(right confluent of
the Amur R.)

Michikan (400,000 kw)

On the Zeya River:
(left tributary of
Amur River)

10 stations, of which of practical importance
for the present time are only

Zeya (800,000 kw) (Incl. 5 and Table VI), and
Gramatukha (800,000 kw)

On the Selendzha River:
(left tributary of the
Zeya River)

11 stations, of which of practical importance
for the present time is only

Dagmara (250,000 kw)

On the Bureya River:
(left tributary of the
Amur River)

Ushuman (40,000 kw)

Daldykanskaya

Bureya (Bureinskaya) (Incl. 5)

On the Ulakhe River:
(tributary of Ussuri
River, a right tribu-
tary of Amur River)

Luzhkovskaya (Incl. 5)

On the Iman River:
(right tributary of
Ussuri River)

Upper-Iman (Incl. 5)

On the Gorin River
(left tributary of
Amur River)

Talanda (100,000 kw)

The Sino-Soviet Commission decided not to utilize the lower Amur (below Khabarovsk) for power production because it would interfere with the fish industry in this area and would inundate great area of fertile land. The construction of power plants listed above will probably begin only in the distant future. It is quite possible that at the time the construction will actually start on the Amur River the present plan will be drastically revised. However, the development of the Zeya River is a real project -- the timber cutting in the area has already been started and the construction of the Zeya Power Plant will be included in the 1959-1965 plan (Table VI).

The Lena River rises in the western slopes of the Baykal Mountain Range at an elevation 930 m above sea level. It empties into the Laptev Sea of the Arctic Ocean. Its length is 4,270 km; drainage area -- 2,420,000 km²; mean annual discharge -- 15,500 m³/sec; maximum flow -- 120,000 m³/sec; minimum flow -- 366 m³/sec; total fall -- 930 m. Hydropower resources of the Lena River are roughly estimated at 20,000,000 kw. There is no reason to suppose that the Lena River will be utilized for power production in the foreseeable future. However, there are two rivers of the Lena River Basin which are intended for utilization in the immediate future. These are the Mamakan and the Vilyuy Rivers.

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The Mamakan River, also called Mama River, is a left tributary of the Vitim River, which, in turn, is a right tributary of the Lena River. It is a turbulent mountain river with high cliff banks. Its average annual discharge is 192 m³/sec. The Mamakan River flows in the perma-frost zone. On this river a series of power plants may be built, the first of which, the Mamakan Hydroelectric Power Plant, is now under construction (Table VI).

The Vilyuy River, the largest left tributary of the Lena River rises from a group of lakes located in the vicinity of the Anaon Mountain Ridge of the Central Siberian plateau in the Arctic Circle area. It is 2,430 km long, its drainage area is 491,000 km², and the mean annual discharge 2,300 m³/sec. It is free from ice 149 days a year and is navigable up to the Syul'dzhyukar village (1,170 km from its mouth). One 1959 source reports that the Seven-Year Plan provides for the construction of a large hydroelectric power plant (Table VI) on the Vilyuy River in the diamond-rich Yakutskaya ASSR. The same 1959 source mentions that the construction of the Vilyuy Hydroelectric Power Plant will be undertaken by the "Angaragesstroy" (the trust for the construction of Hydroelectric Power Stations on the Angara River) which is at present completing the work on the Irkutsk Hydroelectric Power Station.

Part II

This part of the report tabulates below all important hydroelectric power plants arranged by rivers. The tables include only power plants which are built, are under construction, or are proposed for construction in the near future. Only significant power plants are tabulated. Unimportant power plants of low capacity (agricultural, etc) are omitted. Power plants of significant capacity proposed for a distant future or plants which are now merely under discussion are mentioned only in the text of Part I and are omitted from the tables.

There are six tables arranged in the same order as the river basins and areas covered in Section I (see p. 12)

Table I. Hydroelectric Power Plants in Kola Peninsula and Karelia (pp. 41-44)

Table II. Hydroelectric Power Plants of the Baltic Sea and Lake Ladoga Basin (pp. 45-47)

Table III. Black and Caspian Seas Basin (excluding Caucasus) (pp. 48-53)

Table IV. Hydroelectric Power Plants in Caucasus (pp. 54-65)

Table V. Hydroelectric Power Plants in Central Asia and Kazakhstan (excluding Irtysh River Basin) (pp. 66-76)

Table VI. Hydroelectric Power Plants in Siberia and Soviet Far East (pp. 77-82)

Each table is divided in six columns. Stations are grouped in the first column under the river on which they are located and are arranged in the sequence of their location on the river in downstream direction. In general, stations are designated under the name of a city or a river from which they derive their names. Those stations for which it was impossible to ascertain their geographical origin, the names were entered in transliteration from the Russian language.

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Hydroelectric Power Plants in
Kola Peninsula and Karelia

Table I

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kw-hr
<u>Pests-Ioki River</u>						
Kaytakoski	Kaytakoski Waterfalls, Murmanskaya o., RSFSR	under construction				
Yaniskoski	Yaniskoski Waterfalls, Murmanskaya o., RSFSR	completed in 1951				
Rayaskoski	Rayaskoski Waterfalls, Murmanskaya o., RSFSR	completed in 1955				10 (by one unit in one month)
<u>Tuloma River</u>						
Tuloma	Murmashi, Murmanskaya o., RSFSR, 26 km from Murmansk	started in 1937; 3 units in 1938; post-war recon- struction in 1949	18	48.0	4	200
<u>Niva River</u>						
Niva I	near Zashchek RR Sta., Murmanskaya o., RSFSR, at Lake Man- zha, (30 km. N of Kovdva)	completed in 1953	40	30.0		150

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Hydroelectric Power Plants in
Kola Peninsula and Karelia

Table I (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity MW	Number of Units	Average Annual Output mill kw-hr
<u>Niva River</u>						
Niva II	near Nivakiy (Nivastroy) Murmanskaya o., RSFSR, between lakes Pinosero and Plesosero (15 km N of Kandalaksha)	completed in 1937	37	60.0	4	360
Niva III	near Kandalaksha, between lake Plesosero and Kandalaksha Bay, Murmanskaya o., RSFSR	completed in 1950	78	150.00	4	840
<u>Kuma-Iova-Kovda River</u>						
Kuma	NW of Kesten'ga Karel'skaya ASSR	scheduled for completion in 1956-1960				
Iova	at the border of Karel'skaya ASSR and Murmanskaya o., RSFSR	under construction in 1957		80		

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Hydroelectric Power Plants in
Kola Peninsula and Karelia

Table I (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity MW	Number of Units	Average Annual Output mill. kWh
<u>Kuma-Tova-Kovda River</u>						
Knyash'iya Guba (Knyashegubakaya)	Zelenyy Bor, Mur- manskaya o., RSFSR	started in 1955; completed in 1956	38	128	4	
Vyg River (part of White Sea Canal System)						
Matkoshuya	Just south of Sennovets, Karel'skaya ASSR	completed in 1953	10	44		
Vygostrov	at Vygostrov, Karel'skaya ASSR	planned for completion in 1956-1960				
Onda River (tributary of Vyg River)						
Onda	probably near the confluence of Onda and Vyg Rivers, Karel'skaya ASSR	completed in Dec 1956		80	4	

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Hydroelectric Power Plants in
Kola Peninsula and Karelia

Table I (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kw/hr
<u>Suna River</u>						
Pali'ye	near Girvas Settlement and Lake Pali'ye, Karel'skaya ASSR	completed in 1954		22		110
Pali'ye-Sandal	between lakes Pali'ye and Sandal, Karel'skaya ASSR	scheduled for completion in 1956-1960		8		30
Kondepega	Kondepega, 2 km from Kivach RR Sta., Karel'skaya ASSR	started in 1929; post-war recon- struction in 1947	29	27.5	1 x 1.5 1 x 4.0 2 x 11	140

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Hydroelectric Power Plants of
the Baltic Sea and Lake Ladoga Basin

Table II

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output Milli kw-hr
<u>Vuoksa River</u>						
Knso	Svetogorsk, Lenin- gradskaya o., RSFSR, 15 km downstream from Lake Saimaa	started in 1945; completed in 1947	15.5	100	4	
Rouhiala	Lesogorskiy, Lenin- gradskaya o., RSFSR, 7 km downstream of Knso station	2 units in 1940; reconstructed in 1945; completed in 1946	15.5	100	4	
Vuoksa (Lower)	downstream of Rouhiala station, at Lake Ladoga, Leningradskaya o., RSFSR	planned		100	4	
<u>Swir' River</u>						
Swir' (Upper)	Podporosh'ye, Leningradskaya o., RSFSR	started in 1936; completed in 1952	14	160	4	700
Swir' (Lower)	Swir'stroy, Leningradskaya o., RSFSR, 143 km from Lake Onega	started in 1933; post-war recon- struction completed in 1948	11	120	4	540

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Hydroelectric Power Plants of
the Baltic Sea and Lake Ladoga Basin

Table II (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity MW	Number of Units	Average Annual Output mill. kWhr
<u>Volkhov River</u>						
Volkhov	Volkhov, Leningradskaya o., RSFSR	completed in 1926; post-war reconstruction in 1944; replacement of equipment planned for 1958-1961	10.5	66 (1944) 80 (planned for 1958-1961)	8 (main) 2 (auxiliary)	360.4 (1936); increase of 56 mill kWhr planned
<u>Narova (Narva) River</u>						
Narva	between Narva, Estonian SSR, and Ivangorod, Leningradskaya o., RSFSR	completed in 1955		125	3	
<u>Zapadnaya Dvina (Daugava) River</u>						
Vitebsk	2 km from Zdravnevo, Vitebskaya o., Belorusskaya SSR	survey completed in 1956; scheduled for completion during 1956-60	18	76		

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Hydroelectric Power Plants of
the Baltic Sea and Lake Ladoga Basin

Table II (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kw-hr
<u>Zapadnaya Dvina</u> <u>(Daugava) River</u>						
Plavinas (Flyavin'skaya)	near Aysraukle, Latviyskaya SSR	construction scheduled to start in 1956- 1960; 1st unit to start in 1962		120	6	
Kegums	Kegums, Latviyskaya SSR, 48 km upstream from Riga	3 units 1939; post-war recon- struction in 1947; 4 units in 1953	15.75	70	4	270
<u>Neman (Memnas)</u> <u>River</u>						
Kaunas	Petrasiunai, 12 km upstream from Kaunas, Litovskaya SSR	under construction since 1955; 1st unit scheduled to start in 1959	20 max 12 min	90	4	

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Black and Caspian Seas Basin
(excluding Caucasus)

Table III

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity MW	Number of Units	Average Annual Output mill kWhr
<u>Dniestr River</u> Dubossary	Novyye Dubossary, above the city of Dubossary, Moldavskaya SSR	2 units in Dec 1954; completed in 1955	16.7	40	4	160
<u>Tereblya and Rika Rivers</u> Tereblya-Rika (also called Zakarpatskaya)	Dam on Tereblya R., near Vulshary; powerhouse on Rika R., near Mikuliy Syetnyy, Zakarpatskaya oblast, USSR above Rika	First unit on Feb 20, 1956; completed in 1956	about 280 (difference between elevations of 2 rivers)		3	
<u>Dnestr River</u> Kiyev	near Kiyev, Kiyevskaya o., a little below the confluence of Desna and Dnestr rivers	planned for indefinite future				

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Black and Caspian Seas Basin
(excluding Caucasus)

Table III (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kw-hr
<u>Dnepr River</u>						
Kaniv	Kaniv, Cherkasskaya o., Ukrainskaya SSR	const. planned to start during 1956-60	12	185		783
Kremenchug	Taburishche, 14 km above Kremenchug, Poltavskaya o., Ukrainskaya SSR	under construction since 1954; scheduled to start in 1960	18	625	12	1,475
Dneprodzerzhinsk	N.W. suburb of Dneprodzerzhinsk, Dnepropetrovskaya o., Ukrainskaya SSR	under construction since 1956	12	350	8	1,245
Dnepr im. Lenin	Zaporozh'ye, Zaporozhskaya o., Ukrainskaya SSR	started in 1932; completed in 1934; postwar recon- struction: 3 units in 1947; completed in 1950	35.3	650	9	3,612
Kakhovka	Novaya Kakhovka, Khersonskaya o., Ukrainskaya SSR	completed in 1956	16.4	312	6	1,449

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Black and Caspian Seas Basin
(excluding Caucasus)

Table III (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity MW	Number of Units	Average Annual Output mill kw-hr
<u>Don River</u>						
Tsimlyanskaya	near Tsimlyanskaya, Rostovskaya o., RSFSR	first unit in 1952; completed in 1954	26.6 (at dam)	160	4	750
<u>Volga River</u>						
Ivan'kovo	Ivan'kovo, Kalininskaya o., RSFSR, at the entrance to the canal in Moskva	completed in 1937	11	30	2	180
Uglich	Uglich, Yaroslavl'skaya o., RSFSR	1st unit in 1940; 2nd unit in 1941	11	110	2	240
Rybinsk (formerly Shcherbakov)	Rybinsk, Yaroslavl'skaya o., RSFSR, on Sheksna R., 2 km above its confluence with Volga R.	1st unit in 1941; completed in 1950	18	330	6	1,000
Gork'iy	5 km upstream of Gorodets, Gor'kovskaya o., RSFSR	first 4 units in 1955; completed in 1956	13	400	8	1,600

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Black and Caspian Seas Basin
(excluding Caucasus)

Table III (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kw-hr
<u>Volga River</u>						
Cheboksary	25 km downstream of Cheboksary, Chuvashskaya ASSR, RSFSR	construction planned to begin during 1956-1960	18	840	12	3,800
Volga im. V. I. Lenin (renamed from Kuybyshev)	Zhigulevsk (right bank); Komsomol'skiy (left bank); Kuybyshevskaya o., RSFSR	1st unit in Dec 1955; last unit in Oct 1957	24	2,100	20	10,520
Saratov	near Balakovo, Saratovskaya o., RSFSR	under construction since 1956	14	1,000	22	6,000
Stalingrad	Stalingrad, Stalingradskaya o., RSFSR	under construction since 1950; stator of first turbine installed in June 1957; scheduled for completion in 1956-1960	23	2,310	22	10,860
Lower-Volga (Astrakhan')	near Yenotayevka, approx. 172 km upstream of Astrakhan', Astrakhan'skaya o., RSFSR	problematical	16	1,220	—	7,200

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Black and Caspian Seas Basin
(excluding Caucasus)

Table III (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kwhr
<u>Kama River</u>						
Solikamsk (Upper-Kama)	Tul'kino Village, Permskaya o., RSFSR, 10 km below the confluence of Kama and Vishera rivers; 30 km above Solikamsk	planned for indefinite future		600		
Kama; formerly also called Molotov (now Perm')	Iavshino, 15 km upstream of Perm', Permskaya o., RSFSR	first units in 1954; completed in July 1957	19	504	24	1,750
Votkinsk	near Saygatka, 25 km downstream of Votkinsk, Permskaya o., RSFSR	under construction since 1954; first units are scheduled to be put into operation by the end of 1960	17	1,000	10	1,970
Lower-Kama	Belyakhch, Tatarskaya ASSR, RSFSR, below the con- fluence of Vyatka and Kama rivers	start of con- struction was scheduled for 1956-1960	19	1,400	18	4,470

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Black and Caspian Seas Basin
(excluding Caucasus)

Table III (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity MW	Number of Units	Average Annual Output mill kw-hr
<u>Kos'va River</u> Shirokovskaya	approx. 15 km SE of Gubakha, Permskaya o., RSFSR	completed in 1947	34	28	2	130
<u>Ufa River</u> Pavlovka (also called Ir.)	near Pavlovka, Bashkirskaya ASSR, RSFSR	under construction since 1950; scheduled to be put into operation in 1958	20 min 33 max	160	6 (as planned in 1946 for 100,000 kw.)	
<u>Ural River</u> Irikliński	near Irikliński Settlement, Orenburgskaya o., RSFSR	under construction		45	6	

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Hydroelectric Power Plants in Caucasus
(North Caucasus)

Table IV (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kw-hr
<u>Belaya River</u>						
Dakhovskaya	near Dakhovskaya, Krasnodarskiy kray, RSFSR	construction started during 1956-1960 period		planned as the largest on Belaya R.		
Maykop	near Maykop Krasnodarskiy kray, RSFSR	put in service in 1950	21		12,050 kw	
Belorechenskaya	near Belorechenskaya, Krasnodarskiy kray, RSFSR	completed in 1955	44.8		17,660 kw	
<u>Mzymta River</u>						
Krasnaya Polyana (also known as Sochi)	Krasnaya Polyana, Krasnodarskiy kray, RSFSR	completed in 1950	99.5 (at turbines)	29.2	4	

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Hydroelectric Power Plants in Caucasus
(North Caucasus)

Table IV (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kw-hr
<u>Terek River</u>						
Dar'yul	Kasbegi village, Gruzinskaya SSR	survey started in 1956	670 (at turbine)	260	4	1,000
Ezminskaya	In Gruzinskaya SSR, between Dar'yul and Ordshonikidze power plants	completed in 1954	161		3	
Ordshonikidze	Ordshonikidze, Severo-Osetin- skaya ASSR	started operation in 1948; completed	26.2 (at turbine)	18 (planned in 1936)	capacity of 1 unit 3,400 kw (1957)	107 (planned in 1936)
<u>Gisel'don River</u>						
Gisel'don	Verkhnyaya Koban' village, Severo- Osetinskaya ASSR	completed in 1935 reconstructed in 1944	289 net and 312 gross at power- house	22.5	3	65

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Hydroelectric Power Plants in Caucasus
(North Caucasus)

Table IV (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kw-hr
Baksan River						
Baksan	Baksanges, Kabardino-Balkarskaya ASSR	completed in 1937; reconstructed in 1946	91.5 (net)	25	3	135
Sulak River						
Cherkoy	Village of Cherkoy, Dagestanskaya ASSR; 75 km from Makhachkala and 120 km from Groznyy	construction planned to start after completion of Chiryurt Station; to be completed in 1969-70	200-220 (estimated in 1931)	220 (planned in 1935)		2,000 (planned in 1935)
Chiryurt	near Verkhnyy Chiryurt village, Dagestanskaya ASSR; 6 km from Chiryurt RR Sta.	under construction since 1954; completion scheduled for 1959	30 (estimated in 1931)	64		
Karakoyusu River (Sulak River Basin)						
Gergebil'	near Gergebil' settlement, Dagestanskaya ASSR	completed in 1937	45.10	4.5	5	27

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Hydroelectric Power Plants in Caucasus.
(Transcaucasia)

Table IV (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kwhr
<u>Gumista River</u> Sukhumi	Dam on East Gumista R., near Mikhaylovka village, 32 km from Sukhumi; powerhouse on West Gumista R., near Andreyevka village, 23 km from Sukhumi, Abkhasskaya ASSR, Gruzinskaya SSR	completed in 1948	215 (at power- house)	20	3	100
<u>Rioni River</u> Gumati I	Gruzinskaya SSR 7 km upstream from Kutaisi	completed in 1958		about 72 (combined capacity of Gumati I and Gumati II)	4	
Gumati II	Gumtigas settle- ment, between Rioni and Delimastaro villages, Gruzinskaya SSR	completed in 1956			3	

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Hydroelectric Power Plants in Caucasus
(Transcaucasia)

Table IV (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kwhr
<u>Rioni River (cont.)</u>						
Rioni	powerhouse near Rioni RR Sta., dam 1 km upstream from Kutaisi, Georgianskaya SSR	completed in 1934	60.8	50	4	240
<u>Ladzhemuri River</u>						
Ladzhemuri (underground power plant)	Ladzhemuri settle- ment, near Adzhar village, 100 km from Kutaisi, Georgian SSR	under construction, scheduled for operation before 1960		about 150		
<u>Tribuli River</u>						
Tribuli	Tribuliges settle- ment, near Dzevri village, Georgian SSR	completed in 1956		approx- imately 85	4	

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Hydroelectric Power Plants in Caucasus
(Transcaucasia)

Table IV (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kw-hr
<u>Shaori River</u> (tributary of Tkibuli River)						
Shaori	upstream from Tkibuli R. power plant, Gruzinskaya SSR	completed in 1955	very high		2	
<u>Bshuaba River</u> (tributary of Katsabani River)						
Bshuaba	Makharadzevskiy r-n, Gruzinskaya SSR	2 units in 1956; completed in 1957				
<u>Adzharis-Tskhalti</u> <u>River</u>						
Adzharis-Tskhalti	near Makhuntseti, 35 km from Batumi, Gruzinskaya SSR	completed in 1937- 1938	41.4	16	2	105

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Hydroelectric Power Plants in Caucasus
(Transcaucasia)

Table IV (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kw-hr
<u>Kura River</u>						
Chitakhevi	Borzhomskiy r-n, Gruzinskaya SSR	completed in 1951		18		
Zemo-Avchaly	near Zages RR Sta., 14 km upstream of Tbilisi, Gruzinskaya SSR	completed in 1938	20	37	6 4 x 3,200 kw 2 x 12,000 kw	210
Ortachaly	Tbilisi, Gruzinskaya SSR	completed in 1956	10.5 (as turbine)	18.9	3	
Akstafa	downstream of Kurakhkhesaman Village, near Akstafa, Azerbaydzhanskaya SSR	Preliminary stage of construction	approx. 70	260	4	
Mingeaur	near Mingeaur, Azerbaydzhanskaya SSR	completed in 1954	70 (on dam)	360	6	
Varvara	near Varvara, 13 km below Mingeaur, Azerbaydzhanskaya SSR	completed in 1957		17	3	

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Hydroelectric Power Plants in Caucasus
(Transcaucasia)

Table IV (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mc	Number of Units	Average Annual Output mill kw/hr
Khrani River (tributary of Kura River)						
Khrani I	near Rosenberg village, Grusin- skaya SSR	completed in 1949	430	90	3	227
Khrani II (underground)	Khranges-2 village, Grusin- skaya SSR; 23 km downstream from Khranges I	under construction since 1954; scheduled for completion before 1960				about 450
Dzoraget River (tributary of Kura River)						
Dzoraget	2.5 km from Kolageran' RR Sta., Armenianskaya SSR (dam on Dzoraget R., powerhouse on Debetagat R.)	completed in 1933; reconstructed in 1947	105 (at turbine)	22.2	3	86.7

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(Transcaucasia)

Table IV (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kw-hr
Iori River (tributary of Kura R.)	irrigation canals	completed in 1953		36 (estimated combined capacity)		
Sangeri power stations (probably 4)						
Tertser River (tributary of Kura River)	Madagis village, Azerbaydshanskaya SSR	in operation since 1945	136 to 170	50	3	246
Tertser No. 2 (also called Madagis)						
Rasdan River	Sevan, Armenyanskaya SSR	completed in 1949	60	23		120
Sevan (also called Osernaya) (underground station)						

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Hydroelectric Power Plants in Caucasus
(Transcaucasia)

Table IV (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kwhr
Rasdan River (cont.)						
Atarbekyan (also called Karavansaray) (underground station)	near Akhta, Armenyanskaya SSR	under construction	137 (pro- posed in 1936)	60 (proposed in 1936)		
Gyumush	near Gyumush, Armenyanskaya SSR	completed in 1953	300	260 (proposed in 1936) 224 (1955 source)	6	930
Arzani (underground station)	Arzani, Armeny- anskaya SSR	completed in 1957	115	66	3	
Kanaker	near Kanaker, Armenyanskaya SSR, 9 km upstream from Yerevan City	completed in 1936	170	88	6	400

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Hydroelectric Power Plants in Caucasus
(Transcaucasia)

Table IV (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kw-hr
<u>Rasdan River (cont)</u>						
Yerevan (as known in 1957)	Yerevan, Arman- skaya SSR	under construction since 1956; scheduled for completion in 1959-1960				
Yerevan No. 1 (as known in 1932)	Yerevan, Arman- skaya SSR	completed in 1929		4.8 (1932)	2	26
Yerevan No. 2 (as known in 1932)	Yerevan, Arman- skaya SSR; 2 km downstream of Yerevan No. 1 power plant	completed in 1932	19	2.4 (1932)	1	12
<u>Vorot'n River</u>						
Tatevskaya	Armanyskaya SSR	construction scheduled to start during 1958-1960	617	estimated 100 to 160		

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Hydroelectric Power Plants in
Central Asia and Kazakhstan
(excluding Irtysh River Basin)

Table V

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kwhr
Vakhsh River (tributary of Amu-Dar'ya)						
Golevnaya	near Kurgan-Tyube, Tadzhikskaya SSR	under construction since 1956	22 min 30 max			
Ak-Gasinskiy Irrigation Canal (Branch of the Vakhsh Canal)						
Perepadnaya	about 22 km down- stream from Golovnaya GES, near Oktyabr'sk, Tadzhikskaya SSR	scheduled to start operation in 1958		30	3	

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Hydroelectric Power Plants in
Central Asia and Kazakhstan
(excluding Irtysh River Basin)

Table V (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kw-hr
Varsob River (tributary of Kafirnigan R., tributary of Amu-Dar'ya)						
Varsob I also called Upper Varsob (Verkhne-Varsob- skaya)	7 km upstream of Stalinsk, Tad- zhikskaya SSR	completed	46.5 (at turbines)	7.4 (1937)	2	40
Varsob II also called Lower-Varsob (Nizhne- Varsobskaya)	northern outskirts of Stalinsk, Tadzhikskaya SSR	completed in 1951	74 (at turbines)	14	2	92
Varsob III	on Dnyshambinka River, southern outskirts of Stalinsk, Tadzhikskaya SSR	completed in 1954		less than 14	2	

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Hydroelectric Power Plants in
Central Asia and Kazakhstan
(excluding Irtysh River Basin)

Table V (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kwhr
<u>Syr Darya River</u>						
Kayrak-Kum also called "Druzhba Karodov" (Friendship of Peoples)	Kayrakum, near Tashkent, Tashkent o., Tadzhikskaya SSR	completed in 1957	22.5 (gross head esti- mated in 1945)	128	6	1,000
Farkhad	near Begovat, Tashkentskaya o., Uzbekskaya SSR	completed in 1949	32 (at turbines)	120	4	
<u>Marya River</u>						
Uch-Kurgan No. 1	upstream from town of Uch-Kurgan, Mamanganskaya o., Uzbekskaya SSR	under construction since 1956	17.6	160		1,328 (estimated in 1939)
Mamangan No. 1	on Yangi-aryk canal, near Mamangan, Mamanganskaya o., Uzbekskaya SSR	put in operation during 1951-1955				

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Hydroelectric Power Plants in
Central Asia and Kazakhstan
(excluding Irtysh River Basin)

Table V (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kwhr
<u>Maryn River (cont.)</u>						
Mamangan No. 2	on the chute from Yangi-aryk canal, into Mamangan-say canal, near Mamangan, Mamangan- skaya o., Uzbekskaya SSR	put into operation in 1946				
<u>Shaarikhansay Canal</u> (Fed by the Kara- Dar'ya R., confluent of the Syr-Dar'ya R.)						
Shaarikhanskaya No. 0	Oshskaya o., Kirgizskaya SSR	under construction in 1957		22		
Shaarikhanskaya No. 6	Andishanskaya o., Uzbekskaya SSR	completed in 1949				
Shaarikhanskaya No. 7	Andishanskaya o., Uzbekskaya SSR	completed in 1953				

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Hydroelectric Power Plants in
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Table V (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kw-hr
Chirchik River						
Tavakskaya (Tavaksky)	Tavaksky, Tashno- Kazakhstanskaya o., Kazakhstanskaya SSR	completed in 1942; expanded in 1956	approx. 55	73.6 (1942)	4 (in 1942)	
Komsomol'sk	NE suburbs of the town of Chirchik, Uzbekskaya SSR	completed in 1942; expanded in 1956	66 (at turbines)	86.4 (1942)	4 (in 1942)	
Troitskaya (Ab-Kavak I-bis)	near Troitskoye, Uzbekskaya SSR	construction started before the war and was inter- rupted during the war; mentioned as under construction in 1948; no further information available.	43 (planned in 1934)	88 (planned in 1934)	4 (planned in 1934)	
Ab-Kavak I	near Troitskoye, Uzbekskaya SSR	completed in 1943; expanded in 1951	28.2	11 (1943)	1 (in 1943)	

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Hydroelectric Power Plants in
Central Asia and Kazakhstan
(excluding Irtysh River Basin)

Table V (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity MW	Number of Units	Average Annual Output mill kw-hr
<u>Bos-Su Canal</u>						
Ak-Kavak II	near Kibray, Uzbekskaya SSR	completed	12	9	2	
Ak-Kavak III (Kibrayskaya)	near Kibray, Uzbekskaya SSR	completed	18.1	11	1	
Kadyr'iya	Kadyr'iya, Uzbekskaya SSR	completed		13.2	4	
Salar	Tashkent, Uzbekskaya SSR	completed	17.6	11	2	
Bos-Su	Tashkent, Uzbekskaya SSR	completed	12.7	5	4	
Sheykhan-teur	Tashkent, Uzbekskaya SSR	completed				
Burdshar I	Tashkent, Uzbekskaya SSR	completed	18.5	6	2	
Burdshar II	Tashkent, Uzbekskaya SSR	completed				
Ak-Tepe	Tashkent, Uzbekskaya SSR	completed	38.6	15	2	

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Hydroelectric Power Plants in
Central Asia and Kazakhstan
(excluding Irtysh River Basin)

Table V (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kw-hr
<u>Boz-Su Canal (cont.)</u>						
Lower Boz-Su I	Tashkent, Uzbekskaya SSR	completed	28.2	20	2	
Lower Boz-Su II	near Tashkent, Uzbekskaya SSR	completed			2	
Lower Boz-Su III	near Tashkent, Uzbekskaya SSR	completed				
Lower Boz-Su IV	downstream from Lower Boz-Su III Station, Uzbekskaya SSR	completed				
Lower Boz-Su V	downstream from Lower Boz-Su IV Station, Uzbekskaya SSR	under construction				
Lower Boz-Su VI	downstream from Lower Boz-Su V Station, Uzbekskaya SSR	completed				

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Table V (cont.)

Hydroelectric Power Plants in
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Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kw-hr
<u>Ili River</u> Kapchagayskaya	at Kapchagayskoye Gorge, 70 km down- stream from Alma- Ata and 11 km from Ili settlement, Almatinskaya O., Kazakhskaya SSR	construction planned to begin during 1956-1960				
Bol'shaya Almatinskaya River (tributary of Ili R.)						
Alma-Ata No. 1, also called Osernaya (Lake Side)	at Lake Almatinskoye, 42 km upstream from city Alma-Ata, Almatinskaya O., Kazakhskaya SSR	completed in 1953		15.6		
Alma-Ata No. 2, also called Osernaya No. 2 (Lake Side No. 2)	a few miles down- stream from Alma- Ata No. 1 station	under construction since 1954; scheduled to be put in operation in 1958				

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Hydroelectric Power Plants in
Central Asia and Kazakhstan
(excluding Irtysh River Basin)

Table V (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mr	Number of Units	Average Annual Output mill kw-hr
Bol'shaya Almatinka River (cont.)						
Alma-Ata No. 3						
Alma-Ata No. 4						
Alma-Ata No. 5	between Lake Alma- atinskoye and the city of Alma-Ata	opened in 1944				
Alma-Ata No. 6	"	opened in 1946				
Alma-Ata No. 7	"	opened in 1946				
Alma-Ata No. 8	"	opened in 1948				
Alma-Ata No. 9	"	opened in 1944				
Alma-Ata No. 10	"	opened in 1944				
Alma-Ata No. 11	Alma-Ata, Almatinskaya o., Kazakhskaya SSR	opened in 1944				

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Hydroelectric Power Plants in
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Table V (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity MW	Number of Units	Average Annual Output mill kWhr
<u>Dargom Irrigation Canal</u> (Fed by the Zeravshan River)						
Rhishran (Rhishranskaya)	Rhishran, 12 km from Samarkand, Samarkand- skaya o., Uzbekskaya SSR	completed	about 38 (planned in 1939)	22	3	
<u>West Chu Canal</u> (Fed by Chu R.)						
Voroshilovskoye I	near Voroshilovskoye, Frunzenskaya o., Kirgizskaya SSR	first unit in 1943			2 (planned in 1946)	
Voroshilovskoye II	near Voroshilovskoye, Frunzenskaya o., Kirgizskaya SSR	put in operation in 1947				
Voroshilovskoye III	near Voroshilovskoye, Frunzenskaya o., Kirgizskaya SSR	put in operation in 1946				

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Hydroelectric Power Plants in
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(excluding Irtysh River Basin)

Table V (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kw-hr
<u>West Chu Canal</u> (cont.)						
Alamedin No. 1	near Frunse, Kirgis- skaya SSR	put into oper- ation in 1945				
No. 2	"	put into oper- ation during 1946-1955				
No. 3	"	"				
No. 4	"	"				
No. 5	"	completed in 1957			3	
No. 6	"	completed in Aug 1958				

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Hydroelectric Power Plants in
Siberia and Soviet Far East

Table VI

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kw-hr
<u>Ob' River</u>						
Kamen' (Kamenskaya)	near the city of Kamen'-na-Obi, 200 km above Novosibirsk, Krasnoyarskiy r-n, Altay- skiy krai, RSFSR	construction planned for 1956-60 after completion of the Novosibirsk Power Plant		630		
Novosibirsk	Mizhniya Chany village, 20 km upstream from Novosibirsk, Novosibirskaya o., RSFSR	5 units in Nov. 1958; scheduled for completion in Feb 1959	19.6 max 11.6 min	400	7	1,687
<u>Irtys' River</u>						
Ust'-Bukhtarma	at the confluence of Bukhtarma and Irtys' rivers, 80 km above Ust'-Kamenogorsk Power Plant; at Serebryanka settlement, Vostochno-Kazakhstan- skaya o., Kazakhskaya SSR	construction started in 1953; scheduled to start operating in 1960		525	7	2,500 (planned in 1957 for 6 units)

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Hydroelectric Power Plants in
Siberia and Soviet Far East

Table VI (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kwhr
<u>Irtysh River (cont.)</u>						
Ust'-Kamenogorsk	just above the confluence of Ablaketha and Irtysh rivers; at Ablaketha settlement, Vostochno- Kazakhstanskaya o., Kazakhskaya SSR	three units in summer 1953; last unit will be installed after start of Bukhtarma Station	40	332 (possibly 425)	4 (possibly 5)	500
Shul'ba (Shul'binskaya)	about 3 km below Staraya Shul'ba village, (140 km below Ust'- Kamenogorsk, Vostochno- Kazakhstanskaya o., Kazakhskaya SSR	in designing stage; start of construction scheduled after Bukhtarma Station is put in operation in 1960	53.9	500		3,260

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Table VI (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kw-hr
Ul'ba River (Tributary of Irtysh R.)						
Ul'ba	3 km from Ul'ba village and 4 km from Ul'bastrov RR Sta., Vostochno- Kazakhstanskaya O., Kazakhskaya SSR	completed in 1942	155	27.6	3	100-125
Gromotukha River (Confluent of Ul'ba R.)						
Gromotukha (Upper) also called Tishinskaya	headworks on Levaya Gromotukha R., powerhouse on Gromotukha R., just above the Tishikha R., Vostochno-Kazakh- stanskaya O., Kazakh- skaya SSR	was scheduled to be put into operation in 1950	550 (gross) (planned in 1936)	66.0 (planned in 1936)	3 (planned in 1936)	
Gromotukha (Lower)	7 km downstream from the Upper Gromotukha Station, Vostochno- Kazakhstanskaya O., Kazakhskaya SSR	was scheduled to be put into operation in 1950		19.5 (planned in 1936)	3 (planned in 1936)	

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Hydroelectric Power Plants in
Siberia and Soviet Far East

Table VI (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kwhr
<u>Yenisey River</u>						
Krasnoyarsk	Shumikha Village Krasnoyarskiy kray, RSFSR; 36 km above, Krasnoyarsk	under construction since 1956	86 (at turbines)	4,000	14	19,140
Yenisey	5 km downstream from Abalakovo Village, Krasnoyarskiy kay, RSFSR; 60 km above Yeniseysk; 27 km below the inflow of Angara River	preparatory survey finished, drilling started in March 1957		6,000	20	35,000
<u>Angara River</u>						
Irkutsk	Kuz'mikha Village, 4 km upstream of Irkutsk, Irkutskaya o., RSFSR	completed in 1958	26 (at turbines)	660	8	4,000

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Table VI (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity kw	Number of Units	Average Annual Output mill kw-hr
<u>Angara River (cont.)</u>						
Bratsk	30 km below Bratsk, Irkutskaya o., RSFSR	construction started in 1955; first four units planned to be put in operation in 1960-1962; full capacity scheduled for 1964	102.1	3,600	18	21,700
Zeya River (Tributary of the Amur R.)						
Zeya	661 km from the mouth of the Zeya R; 6 km above the city of Zeya, Amurskaya o., RSFSR	construction planned to start during 1959-1965; blueprints already drawn; timber cutting started	94 (gross)	800		4,250

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Hydroelectric Power Plants in
Siberia and Soviet Far East

Table VI (cont.)

Name of Hydropower Plant	Location	Date of Operation	Head m	Ultimate Installed Capacity Mw	Number of Units	Average Annual Output mill kw-hr
<u>Mamakan River</u> (Lena R. Basin)						
Mamakan	Mamakan Settlement, Bodaybinskiy r-on, Irkutskaya o., RSFSR; about 1.5 km from the mouth of the Mamakan R.; 12 km below the city of Bodaybo	under construction since the end of 1956; the first 2 units scheduled to be put in operation in 1960	55	60	4	300
<u>Vilyuy River</u> (tributary of the Lena R.)						
Vilyuy	Location is not yet ascertained. Trans- mission line feeding current to the con- struction site will originate at the Mukhtuya Settlement, Yakutskaya ASSR	Preparatory work (workers settlement, etc.) started in 1959				

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Hydropower PlantsTextTablesP.No.P.

Ponyah

20

Poyarkovo

38

Ravat-Kodzhinskaya

32

Rayaskoski

12

I

41

Rechitsa

17

Rioni

25

IV

59

Rouhiala (Lesogorskiy)

15

II

45

Rybinsk (Shcherbakov)

19

III

50

Rzhev

19

Salar

30

V

71

Samarkand

32

Samgori power plants

27

IV

63

Saratov

19

III

51

Sayan

36

Semipalatinsk

35

Sengileyskaya

22

IV

54

Sevan (Ozernaya

27

IV

63

Shaarikhansay 0, 6 and 7

30

V

69

Shaori

26

IV

60

Shavat

28

Shcherbakov (Rybinsk)

19

III

50

Sheykhtaur

30

V

71

Shirokovskaya

20

III

53

Shirokovskaya (Lower)

20

Shnokhsakaya

26

Shul'ba

35

VI

78

Sloni

27

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	<u>P.</u>	<u>No.</u>	<u>P.</u>
Smolensk	17		
Solikamsk	20	III	52
Sovetsk	16		
Stalingrad	19	III	51
Staritsa	19		
Sukhotino	38		
Sukhovakaya	38		
Sukhumi	25	IV	58
Susamyr	30		
Svetogorsk (Enso)	15	II	45
Svir' (Lower and Upper)	15	II	45
Svistukhinskaya	22	IV	54
Takhia-Tash	28		
Talanda	39		
Taligulyan No. 1, 2, and 3	32		
Tarskaya	35		
Tash-Kumyr	30		
Tatevakaya	27	IV	65
Tavakakaya	30	V	70
Tel'minskaya	38		
Tereblya-Rika (Zakarpatskaya)	17	III	48
Tertar No. 1	27		
Tertar No. 2 (Sadagiz)	27	IV	63
Tertar No. 3	27		
Tkibuli	26	IV	59
Tobol'skaya	35		
Togus-Toran	30		
Tokmak	32		

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Totyl

20

Troitskaya (AK-Kavak I-bis)

30

V

70

Troitskoye

20

Tsalykskaya

23

Tsimlyanskaya

18

III

50

Tuloma

13

I

41

Tuloma (Upper)

13

Tuya-Muyun

28

Tymkaya

33

Uch-Kurgan No. 1

30

V

68

Uch-Kurgan No. 2

30

Ufa

III

53

Uglich

19

III

50

Ul'ba

35

VI

79

Unizhsakaya

16

Ushumun

39

Ust'-Bukhtarma

34

VI

77

Ust'-Ilinsk

38

Ust'-Kamenogorsk

34

VI

78

Uychi No. 1 and No. 2

30

Vakhsakaya

33

Vartsikhskiye power plants

25

Varvara

26

IV

61

Varyazhsakaya

20

Varzob I, II, and III

29

V

67

Vilyakhovka

17

Vilyuy

40

VI

82

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<u>Hydropower Plants</u>	<u>Text</u> <u>P.</u>	<u>Tables</u>	
		<u>No.</u>	<u>P.</u>
Vitebsk	16	II	46
Volga, Lower (Astrakhan')	19	III	51
Volga im. Lenin (formerly Kuybyshev)	19	III	51
Volkhov	15	II	46
Voroshilovskoye 1, 2, and 3		V	75
Votkinsk	20	III	52
Vuoksa (Lower)	15	II	45
Vygostrov	14	I	43
Yampol'skiy	16		
Yamyshevskaya	35		
Yaniskoski	12	I	41
Yavanskaya	32		
Yegorlyk No. 1	22	IV	54
Yekabpils	16		
Yenisey	36	VI	80
Yenisey (Lower)	37		
Yerevan	27	IV	65
Yerevan I	27	IV	65
Yerevan II	27	IV	65
Zakarpatskaya (Tereblya-Rika)	17	III	48
Zakhamatabadskaya	32		
Zaleshchinskaya	16		
Zemo-Avchaly	26	IV	61
Zeya	39	VI	81
Zhlobin	17		
Zhvanchikskaya	16		

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Alphabetical Listing of all Rivers Described in the Report

<u>Rivers</u>	<u>Text</u> <u>P.</u>	<u>Tables</u>	
		<u>No.</u>	<u>P.</u>
Adzharis-Tskhali River	26	IV	60
Ak-Gazinskiy Canal (fed by Vakhsh R.)		V	66
Alazani River	27		
Ami-Dar'ya River	28		
Amir River	38		
Angara River	37	VI	80
Ardon River	24		
Argun' River	39		
Atbashiinskiy Canal (fed by Chu R.)	32		
Baksan River	24	IV	57
Belaya River	22	IV	55
Bol'shaya Almaatinka River	31	V	73
Bol'shoy Yegorlyk River	22	IV	54
Boz-Su Canal (fed by Chirchik R.)	30	V	71
Bureya River	39		
Bzhuzha River	26	IV	60
Chirchik River	30	V	70
Chu River	32		
Chu Canal (fed by Chu R.)	32	V	75
Chusovaya River	20		
Dargom Canal (fed by Zeravshan R.)	31	V	75
Dnepr River	17	III	48
Dnestr River	16	III	48
Don River	18	III	50

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<u>Rivers</u>	<u>Text</u> <u>P.</u>	<u>Tables</u>	
		<u>No.</u>	<u>P.</u>
Dzoraget River	26	IV	62
Fergana Canals (fed by Naryn and Kara-Dar'ya rivers)	30		
Georgiyevskiy Canal (fed by Chu R.)	32		
Gizel'don River	24	IV	56
Corin River	39		
Gromotukha River	35	VI	79
Gumista River	25	IV	58
Ili River	31	V	73
Iman River	39		
Inguri River	25		
Iori River	27	IV	63
Irtysk River	33	VI	77
Kama River	20	III	52
Kara-Dar'ya River	30		
Karakoysu River	24	IV	57
Kara-Kum Canal (fed by Amu-Dar'ya R.)	28		
Kem' River	13		
Khrami River	26	IV	62
Kos'va River	20	III	53
Kuban' River	22		
Kuma-Iova-Kovda River	13	I	42
Kura River	26	IV	61
Ladzhnanuri River	25	IV	59
Lena River	39		
Neankan River	40	VI	82
Naryn River	23	IV	55

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<u>Rivers</u>	<u>Text</u> <u>P.</u>	<u>Tables'</u>	
		<u>No.</u>	<u>P.</u>
Narova (Narva) (River)	15	II	46
Naryn River	29	V	68
Neman River	16	II	47
Nevinnomysskiy Canal (fed by Kuban' R.)	22	IV	54
Niva River	13	I	41
Ob' River	32	VI	77
Oka River	19		
Onda River	14	I	43
Paats-Ioki River	12	I	41
Razdan River	27	IV	63
Rioni River	25	IV	58
Selendzha River	39		
Shearikhansay Canal (fed by Kara-Dar'ya R.)	30	V	69
Shaori River	25	IV	60
Shavat Canal (fed by Amu-Dar'ya R.)	28		
Sulak River	24	IV	57
Suna River	14	I	44
Svir' River	15	II	45
Syr-Dar'ya River	29	V	68
Tereblya and Rika Rivers	17	III	48
Terek River	23	IV	56
Tertar River	27	IV	63
Tkibuli River	25	IV	59
Takhenis-Takali River	25		
Tulona River	13	I	41

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<u>Rivers</u>	<u>Text</u> <u>P.</u>	<u>Tables</u>	
		<u>No.</u>	<u>P.</u>
Turkmen Canal (Main Turkmen Canal fed by Amu-Dar'ya R.)	28		
Ufa River	20	III	53
Ulakhe River	39		
Ul'ba River	35	VI	79
Ural River	21	III	53
Vakhsh River	29	V	56
Varzob River	29	V	67
Vilyuy River	40	VI	82
Volga River	18	III	50
Volkhov River	15	II	46
Vorotan River	27	IV	65
Vuoksa River	14	II	45
Vyg River	13	I	43
Yenisey River	35	VI	80
Zapadnaya Dvina (Dangava) River	15	II	46
Zeravahan River	31		
Zeya River	38, 39	VI	81

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<u>Rivers</u>	<u>Text</u> <u>P.</u>	<u>Tables</u>	
		<u>No.</u>	<u>P.</u>
Turkmen Canal (Main Turkmen Canal fed by Amu-Dar'ya R.)	28		
Ufa River	20	III	53
Ulakhe River	39		
Ul'ba River	35	VI	79
Ural River	21	III	53
Vakhsh River	29	V	56
Varzob River	29	V	67
Vilyuy River	40	VI	82
Volga River	18	III	50
Volkhov River	15	II	46
Vorotan River	27	IV	65
Vuoksa River	14	II	45
Vyg River	13	I	43
Yenisey River	35	VI	80
Zapadnaya Dvina (Daugava) River	15	II	46
Zeravshan River	31		
Zeya River	38, 39	VI	81

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